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A TEXT-BOOK

OF

PRACTICAL THERAPEUTICS

WITH ESPECIAL REFERENCE TO THE

APPLICATION OF REMEDIAL MEASURES TO DISEASE

AND THEIR

EMPLOYMENT UPON A RATIONAL BASIS

BY

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TWENTY-FIRST EDITION

ENLARGED, THOROUGHLY REVISED AND LARGELY REWRITTEN

ILLUSTRATED WITH 145 ENGRAVINGS AND 6 PLATES

LEA & FEBIGER
PHILADELPHIA
1930

The object of this book is to place the subject of treatment before the reader so that it may be applied at the bedside in a rational manner.

The endeavor of the true physician is:

"To cure sometimes, to relieve often, to comfort always."

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PREFACE TO TWENTY-FIRST EDITION.

The author attributes the call for a twenty-first edition of his *Practical Therapeutics* to the fact that his main object, namely, to provide a useful text for the student and practitioner, has always been kept in mind. The reader of such a book always wishes information as to the best drug, or combination of drugs, which he can use for the benefit of a given patient, or, to put it differently, he wants to know which one to use, when to use it, how to use it, and, equally important, when not to use it because the contraindications are greater than the indications.

A point of interest is the fact that methods of treatment constantly change in many respects and new remedies appear, some of which are valuable while others are not worthy of employment. No one who is not particularly interested in therapeutics has a true conception of the advances and changes which continually occur.

In addition to important changes in the text of the twentieth edition, new drugs, or measures for relief not medicinal, have been introduced. Among these may be named the present conception of the manner of action of calcium salts in various states, notably in dropsy and certain types of tetany.

The use of ammonium chloride as a diuretic.

The intravenous use of tartar emetic as a practical specific in the treatment of chancroids.

The differential diagnosis of arsphenamine jaundice and so-called catarrhal jaundice.

A discussion of the value of various preparations of bismuth in the treatment of syphilis.

The use of carbon dioxide in connection with anesthesia and the fact that it is, perhaps, the most valuable remedy in the treatment of obstinate hiccough.

The deleterious effect of prolonged dosage of cinchophen upon the liver.

The discovery by Kamm and his coworkers that the active principle of the posterior lobe of the pituitary can be split into at least two active parts, each of which are definitely therapeutic, in that pitressin represents the principle that raises blood-pressure, and pitocin which is a pure uterine stimulant.

The necessity of clearly understanding that dextrose should always be used rather than ordinary glucose when given by the stomach or intravenously.

The newer views concerning the action of digitalis.

Such new remedies as the powerful viosterol in rickets and the efficient ventriculin in place of liver for relief in pernicious anemia.

A further consideration of the intraspinal use of procaine.

The value of salyrgan as a diuretic in cardiac dropsy and that of hexylresorcinol S.T. 37 as an antiseptic at once powerful and yet not toxic.

The author wishes to thank Dr. G. E. deSchweinitz for his careful revision for the twenty-first time of the articles on Diseases of the Eye in Part IV, Dr. Brooke M. Anspach for revising the text on Abortion and Puerperal Diseases in Part IV, to Dr. Harold W. Jones for his revision of the text on Transfusion in Part III.

The Therapeutic Index has proved a useful means quick reference in obtaining suggestive ideas as to treatment. The general index as well as the Therapeutic Index owes its value to a large extent to the painstaking care of the author's associate, Dr. L. F. Appleman, who has once again lent his aid in dealing with this important part of the volume and who richly deserves the author's thanks.

Finally the reader can be assured that instead of becoming weary of his task in preparing repeated editions the professional approval which has greeted each appearance of a new volume has served more than ever to urge him to make this issue even more useful than its predecessors.

H. A. H.

1801 Spruce Street,
Philadelphia.

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SOLUBILITIES.

Ammonium Benzoate: One gram is about 10 cc water, 35.5 parts of alcohol, and about 8 cc glycerine at 25° C.

Ammonium Chloride: 2.6 parts of water, 100 parts of alcohol, and 8 parts glycerine at 25° C. and in 1.4 parts of boiling water.

Ammonium Valerate: In water and in alcohol, also in ether.

Amyl Nitrite: Miscible with alcohol or ether.

Antimony: *Tartar Emetic:* 12 parts of water at 25° C., 3 parts of boiling water; insoluble in alcohol.

Apomorphine: 50 parts of water, 50 parts of alcohol, 1864 parts of ether, and in 3800 parts of chloroform at 25° C.; soluble in 17 parts of water at 80° C.

Arsenic: Glassy variety, 30 parts of water at 25° C. Oil of turpentine. Crystalline, 100 parts of water at 25° C. Both varieties soluble in 15 parts boiling water. *Arsenic trioxide*, sparingly soluble in alcohol, soluble in about 5 parts glycerine. Both varieties freely soluble in hydrochloric acid, and solution of alkaline hydroxides and carbonates.

Acetylsalicylic Acid: Melts at 135° C. and soluble in 300 parts water; dissolved in alkaline fluids.

Balsam of Peru: Absolute alcohol, chloroform, and glacial acetic acid; partially soluble in ether and alcohol.

Belladonna: Soluble in water.

Benzoine: Almost wholly soluble in 5 parts warm alcohol; soluble in solutions of sodium or potassium hydroxide.

Betanaphthol: 1000 parts of water, 0.8 parts of alcohol, 17 parts of chloroform, and 1.3 parts of ether at 25° C.; in about 80 parts of boiling water; soluble in glycerine and olive oil and easily dissolved by alkali hydroxide solutions.

Bismuth Subnitrate and Bismuth Subcarbonate: Both insoluble in water except to a very slight degree.

Bismuth Subsalicylate: Insoluble in water, alcohol, ether, and chloroform. Soluble in acids.

Borax and Boric Acid: Soluble in 15 parts its weight of water at 77° F., and 0.6 part in boiling water.

Bromide of Potassium: Very soluble in water, less so in alcohol.

Bromoform: Readily in alcohol, slightly in water.

Caffeine: 46 parts of water, 66 parts of alcohol, 530 parts of ether, and 5.5 parts of chloroform at 25° C.; soluble in 5.5 parts of water at 80° C. and in 22 parts of alcohol at 60° C.

Calx: 840 parts of water at 25 C. and in about 1740 parts of boiling water. Insoluble in alcohol.

Camphor: 1000 parts of cold water and in 1 part of strong alcohol.

Camphor Monobromate: Entirely insoluble in water. Freely soluble in alcohol, ether and chloroform.

Carbon (Charcoal): Completely insoluble in water.

Cerium Oxalate: Insoluble in water and alcohol. Freely so in hydrochloric acid.

CHLORAL HYDRATE: Freely soluble in water, alcohol, or ether; also in chloroform, benzene, petroleum benzin, carbon disulphide, fixed and volatile oils. It liquifies when triturated with about an equal quantity of camphor, menthol, thymol, phenol, or antipyrine.

CHLOROFORM: 200 parts of water.

CHRYSAROBIN: Solutions of alkalies, in acids and in ether.

CITRIC ACID: 0.5 part of water, 1.8 parts of alcohol at 25° C.; in about 0.4 part of boiling water, and 30 parts ether.

CODEINE: *Sulphate:* 30 parts of water. *Phosphate:* 23 parts of water.

CREOSOTE: 140 parts of water at 25° C. (not perfectly clear). 120 parts of hot water (clear liquid).

ETHER: 12 times its volume of water at 25° C. It is miscible in all proportions with alcohol, chloroform, petroleum, benzin, benzene, fixed and volatile oils.

ETHEYL CHLORIDE: Slightly soluble in water. Readily soluble in alcohol.

GALLIC ACID: 87 parts of cold water at 25° C., 4.6 parts of alcohol, and 3 parts of boiling water.

GLYCERINE: Soluble in a mixture of 3 parts of alcohol and 1 part of ether. Insoluble in ether, chloroform, carbon disulphide, petroleum benzin, benzene, and fixed and volatile oils.

GLYCERITE OF BOROGLYCERINE: Soluble in water.

GUAIAC: Alcohol, ether, and chloroform. Insoluble in water.

GUAIACOL: Alcohol and ether.

GUAIACOL CARBONATE: 60 parts alcohol, 1 part chloroform. Insoluble in water.

HEXAMETHYLENAMINE: At 77° F. it dissolves in 1.5 parts of water.

IODIDE OF POTASSIUM: 0.7 part of water and about 22 parts of alcohol at 25° C.; in 0.5 part boiling water, 8 parts of boiling alcohol, and 2 parts glycerine.

IODINE: 2950 parts of water, 12.2 parts of alcohol at 25° C. Freely soluble in ether, chloroform, or carbon disulphide.

IODOFORM: 9391 parts of water 60 parts of alcohol, 7.5 parts ether at 25° C.; in about 16 parts of boiling alcohol, in chloroform and fixed and volatile oils; slightly soluble in petroleum benzin.

POTASSIUM ACETATE: 0.5 part of water and 2.9 parts of alcohol at 25° C., with increasing temperature it becomes much more soluble in both liquids.

PYROGALLOL: 1.7 parts of water, 1.6 parts ether and 1.3 parts alcohol.

SACCHARINE: 290 parts of water and in 31 parts of alcohol, but slightly soluble in ether or chloroform at 25° C.; soluble in 25 parts of water at 100° C.

SALICIN: 23.5 parts of water and 88.4 parts alcohol at 25° C.

SALICYLIC ACID: 460 parts of water and 2.7 parts of alcohol at 25° C.

SULPHONAL: 365 parts of cold water and 16 parts of boiling water, and in 60 parts of alcohol and 64 parts of ether.

PRACTICAL THERAPEUTICS.

PART I.

GENERAL THERAPEUTICAL CONSIDERATIONS.

Before entering into a study of the action of drugs upon the living body, it is necessary that the student should possess a clear idea that the word "therapeutics" means the treatment of disease, that he should comprehend fully the reason why resort is had to remedial measures, and, more important than all, that he should grasp the limitations which govern the administration of remedies. He should never forget, as student and practitioner, the following rules:

When called to guide a patient through an illness the physician should be constantly a watchman, and a therapeutist only when necessity arises.

A good physician is one who having pure drugs knows when to use them, how to use them, and, equally important, when not to use them.

Any drug which has the power to do good when rightly used, has the power to do harm if wrongly used.

When a physician gives a drug and the patient improves, care should be taken not to ascribe all the good results to the remedy employed. Nature must be given credit for a large part of the improvement.

In the sixteenth century Ambroise Paré, the father of modern surgery, wrote, "I dressed him; God cured him."

When called to see one who is ill the physician should bear in mind that although one organ may be chiefly in trouble the whole organism is more or less involved, for every part depends upon the healthful performance of its duties upon the other parts. Thus in fevers the patient may not desire food because he instinctively knows that his digestive and assimilative functions cannot deal with it. Too often in acute illness he is made to divert vital energy from protecting him from the invasion of parasites to the dealing with food given with good intent but poor judgment, but, on the other hand, he must not be starved lest starvation decrease his vital resistance to infection.

The physician should always remember that variations from the normal in certain cases of disease may be efforts of Nature to meet the needs of the patient. Increased rapidity of respiration in fever is an endeavor on the part of the body to get rid of heat, and in the dog, for example, this method of cooling the blood by rapid breathing is his chief means of doing this. So too rapid respiration may not only be an endeavor to get rid of CO_2, but it enables the blood to carry oxygen to the tissues so that toxic matters may be the better destroyed. Constant cough may not only be desirable to get rid of profuse secretion or pus, but to empty bronchial or pulmonary cavities of material which, if retained, may cause disaster. Again, cough in the presence of a failing circulation may be an effort to obtain the assistance of the respiratory pump in aiding circulation in the great veins of the thoracic cavity. Anasarca may be an effort to maintain the normal tonicity of the body fluids when the kidneys cannot eliminate the normal quantity of salt. Shivering is an effort on the part of the muscles to raise the body temperature. So, too, free sweating lowers temperature. To wash the nasal mucous membrane in the presence of an epidemic of influenza to prevent infection is foolish as the mucus normally present protects that membrane from infection and imprisons microörganisms. Furthermore the normal nasal mucous membrane has been shown to have great disinfecting power if let alone.

There is too great a tendency to believe that variations in healthy function in the presence of disease are enemies to be fought by the ministrations of the physician. On the other hand, the man who does not believe in the proper use of remedies lacks the very keystone of the arch upon which all medical investigation rests, for the ultimate aim and object of all medical thought and effort is the cure or alleviation of disease. Like other things requiring a thorough knowledge of their component parts, methods of treatment are often much abused by the careless and ignorant, but are a power for good in the hands of the properly educated physician. Further than this, therapeutics is the only universally used part of medicine, for each and every branch must resort to it.

The first duty of the physician when called to a case of illness is to reach a diagnosis as to the cause of the ailment, and not until he has formed a definite idea as to the condition which confronts him should he prescribe any medicinal agent. In certain cases where the symptoms are severe or indicative of immediate danger it may be necessary to give relief by the use of temporary remedies, not only to save life, but also to remove symptoms which, because of their severity, mask the condition so that a diagnosis is impossible. Thus, a patient may be found in collapse or in a state of syncope. The cause of this state may be obscure, but the pulse, heart-sounds, and respiratory action may indicate the need of immediate stimulation. In another instance agonizing pain, as that due to a crisis in locomotor ataxia, or renal or hepatic colic, may require a hypodermic injection of morphine as soon as the physician assures himself that the pain complained of is genuine. In other instances the case may be so obscure that several days of careful study may be necessary to reach a correct diagnosis, and during this time palliative remedies may be required.

Before ordering a drug or method of treatment the physician should have a clear conception of what he is trying to accomplish. No remedy should be given unless there is a distinct indication for its use. The old-fashioned "shot-gun" prescription, containing many ingredients, one or more of which might hit the mark, should be supplanted by the small-calibre rifle-ball sent with directness at the condition to be relieved.

Having decided upon the remedy indicated, the physician must next determine the dose required. This latter decision is almost as important as the first, for very often an error in dosage will cause failure of the remedy. A large part of the therapeutic skill of the physician consists in fitting the dose to the needs of his patient.

In the treatment of all forms of disease the physician must never forget the following influential factors in the case, which are often of greater importance than the measures devoted to the treatment of the disease itself:

1. The maintenance of vital resistance by proper feeding.
2. The elimination of effete materials by the kidneys, bowels, and skin.
3. The relief of annoying symptoms which sap the patient's vitality and often obscure the true state of the system.
4. That sufficient physical and mental rest and sleep are obtained if possible.

1. That the proper use of food in both acute and chronic illness is of great importance is not only manifest, but it has been proved by scientific investigation that lack of food often prevents the system from successfully combating the entrance and growth of infecting microörganisms. The patient who has a greatly lowered vital resistance not only suffers from the effects of the particular disease by which he has been attacked, but not rarely dies from the growth of other microörganisms which find him a fair mark for their attacks, thereby producing what Flexner has well called "terminal infections," and causing Osler to say that "a man rarely dies of the disease from which he is suffering," meaning by this that though he may be ill of a specific infection, other germs really produce the fatal issue. Care in feeding is therefore never to be ignored, and the various ways of feeding and preparing foods must be carefully studied. (See Part III.)

2. It would seem hardly necessary to insist on the importance of maintaining the active elimination of impurities from the body were it not that so little attention is paid by some physicians to these functions. In all infectious diseases the kidneys are required not only to eliminate the ordinary waste products of the body, which usually escape in this way, but in addition the increased waste produced by the fever and the poisons produced directly and indirectly by the growth of the invading microörganisms. It is essential therefore that the patient shall pass urine in sufficient amount to carry off these substances, and this result often may be obtained by giving plenty of

water to drink and increasing diuresis by the use of sweet spirit of nitre and citrate or acetate of potassium, but it is a grave error to give water in excess. Nor is it sufficient to determine that the quantity of urine is normal. Repeated estimations of the solids should be made in all serious cases, to ascertain whether the eliminating function of the kidney is active, for sometimes the flow of urine is sufficient, but the quantity of urinary solids is far below what it should be. Not rarely in disease, and even in apparent health, the patient states that his bowels have moved daily, and the physician is content with this report without making inquiries as to the quantity of the feces or whether the quantity is adequate in regard to the amount of food ingested. Even when the bowels are moved daily we may find after some days that there has been a partial retention of fecal matter, so that the colon becomes filled with feces. Sometimes moderate diarrhea is an effort of Nature to eliminate poisons, and is to be regarded as an aid to the patient, and not to be arrested by constipating remedies. It is also to be recalled that one of the functions of the liver is the elimination and destruction of toxic materials, and therefore the use of a cholagogue not only unloads the bowels, but also aids the liver in one of its most important duties. As the skin is an important eliminating organ, it must be kept clean by frequent washing, and if inactive it must be stimulated to increased activity by rubbing, and in some cases by hot packs or Turkish baths. (See Heat.)

3. It is of importance, as already stated, that symptoms which accompany the progress of various forms of diseases should be modified or removed if they become sufficiently active to produce much discomfort or disturb the patient's rest. Headache, backache, itching, wind colic, etc., can often be entirely removed by simple means and sometimes without the internal use of drugs. It is, on the one hand, important to avoid unnecessary discomfort; and, on the other, care must be taken that in the use of remedies to relieve annoying symptoms we do not mask important diagnostic factors in the case or influence unfavorably the course of the malady. Thus in appendicitis it is wise, as a rule, not to give morphine to relieve the pain, as it will quiet the patient so as to lead him and his attendants to regard the condition as actually healed, when in reality the pathological process is rapidly progressing. Only when the pain is agonizing ought sufficient of the drug be given to allay the excess of pain, and never enough to mask the real condition. It is of vital importance that the physician be not content with the relief of symptoms alone, but that he should regard them as of comparatively little importance, while he searches for and tries to remedy the diseased state itself. Thus, it would be folly to treat the headache of uremia and fail to treat the cause producing it.

Not infrequently care is not taken to discover whether the patient has sufficient sleep or rest. It is perfectly true that if a sick man lies awake an hour he is apt to believe he has been awake all night; but, on the other hand, in severe illness prolonged actual wakefulness is a very exhausting feature of the attack. Every one of experience has seen cases rally when apparently in a most serious state, and convalesce when a good sleep has been given them by the aid of judiciously used drugs. If the patient is getting about the normal amount of sleep in the twenty-four hours, hypnotics should be avoided as if they were poisons.

THE MODES OF ACTION OF DRUGS.

To understand the mode of action of remedial measures it is essential to recall the facts upon which our practice of therapeutics is based. From the earliest times in the history of mankind an endeavor has been made to alleviate and cure disease, and for thousands of years the only reason for applying a remedy in a given case rested upon the belief, not necessarily the fact, that it had done good in an earlier case which presented a similar chain of symptoms or signs. It is manifest that this plan is open to many errors. First, the fact that the patient got better after a given plan of treatment is not a proof in itself that the remedy did the good work. It is possible that the patient would have gotten well if left alone. Second, the physician and the patient in studying the symptoms may very readily misinterpret them, the more so as one patient may place great emphasis on one series of symptoms and another patient magnify other symptoms which to him may seem of great importance, whereas they are, in reality, of little value. Third, as no two human beings react in an identical manner to the influence of disease or remedies, what may be advantageous to one may not be to another. Fourth, a remedy which may be of the greatest value at one stage of a malady may be useless or even harmful at another. All these factors, therefore, stand in the way of obtaining accuracy by treatment based on the principle that because "A" has been bettered, "B" will be benefited by the same plan. It is not to be forgotten, however, that some of these elements of uncertainty can be, and are, eliminated if the physician has experience which enables him to properly weigh the conditions which he sees or feels, and if his experience enables him to attach proper weight to the statements of the patient or his friends as to the conditions present. Again, if a plan of treatment does good in a large series of cases identical in character, it is justifiable assumption that its effects are real. A very large and invaluable part of our methods of treatment at present must rest upon the results of clinical observation for obvious reasons, and for the additional reasons that until the biologist, physiologist, pathologist, and bacteriologist can tell us as to what life is, what disease is, and how both life and disease occur, we cannot explain how a plan of treatment, proved beyond all doubt efficacious, acts. Therapeutics must rest, now and for all time, to some extent upon what bedside experience has taught, and this experience is so large that it is of inestimable value.

At times in the past because of lack of knowledge of the functions of the body and the cause and course of disease, erroneous ideas have developed, particularly when a large series of successful cases led to the belief that a plan of treatment did good, when, in reality, it was valueless. With the discovery that the plan was an error, particularly if the treatment was disagreeable or vigorous, a revulsion of feeling occurred, and medical men leaped to the conclusion that because this plan was wrong all plans of treatment were wrong, and, therefore, worthless, with the result that they became therapeutic agnostics or therapeutic nihilists, than which there is no more miserable object in the presence of disease. At a time when excessive mistaken medication had reached such a point, through the desire of the physician to do good and the demand of the patient that something be done, that actual harm often resulted, these therapeutic nihilists became divided into two factions: one that said "we can do nothing," and the other, with more knowledge of human nature, who really did nothing, but pretended that they did something because they found that mankind insisted upon at least thinking that efforts were being made in its behalf. Led by a clever itinerant theorist, named Hahnemann, they developed the idea of infinitesimal doses, and as these doses were too small to produce any influence, the patient had a chance to get well without having to fight the disease and mistaken efforts in his behalf. Hahnemann's plan of treatment was based, however, on just as little knowledge of disease and of how drugs acted as that of his predecessors, and was more erroneous because, in addition to his ignorance, he developed a lot of mistaken ideas which he evolved out of his inner consciousness, as, for example, that by diluting, grinding, or shaking a drug one could actually increase its power over the functions of the body.

The next step came with the advance of chemistry that give us new drugs and active principles of old ones, so that their complex effects could be better separated, understood, and employed, and simultaneously physiology and pathology began to discover facts which made our conceptions of the functions of the body more clear and, therefore, improved our idea as to what happened in disease. Before this the morbid anatomist had shown us what the conditions were after death, but this gave only a sidelight upon the processes during life. In general terms, the conception of the living body as an aggregation of living cells may be considered to have been the first step toward the more rational therapeutics of today. This conception of the cells of the body has resulted in many therapeutic advances which will be shortly referred to.

The recognition of the fact that the body is an aggregation of living cells was shortly followed by the knowledge that, through differentiation and special development, each cell has its own particular function to perform, and when this function is perverted or arrested illness or death ensues. It also became evident that as cells became highly differentiated as to function and form, they became susceptible to influences which failed to affect other special cells, and knowledge of this fact gave impetus to the next step toward modern therapeutics, because this explained why certain remedies acted upon one part of the body and not on others.

The physical, chemical, and physiological state of the cells of the body may exercise a bearing on the effect of medicinal or poisonous substances. If this is true, we find that the cells of the body may possess properties which render them immune to the effects of such compounds, whether these compounds remain intact or are broken up. Thus, immunity or insusceptibility may be due to the fact that the composition of the cell may be so stable that the drug cannot destroy it. Its envelope may resist penetration of the drug or, even if it is unable to resist penetration, its protoplasm may be of such a nature that the drug is not soluble in it. As an example of permeability we find that the renal cells are permeable to the sulphates; whereas, the cells of the intestinal mucous membrane are impermeable to these compounds. Thus, magnesium sulphate taken by the mouth in a strong solution is unabsorbed and acts only as a purge. If injected in full amount into the blood it is a powerful poison.

The relationship of ions to the effect of inorganic drugs on the body has not been fully determined. When an electrolyte goes into solution some of its ions are set free, and, being charged with positive or negative electricity, on coming in contact with, or entering, the cells thereby produce certain effects or changes—as, for example, stimulation or depression—by altering their electrical state.

Again, certain cells of the body, although they may be susceptible to a given substance if kept continuously in contact with it, nevertheless escape, because it is no sooner taken up than it is cast out.

Many cells otherwise susceptible escape because they have the power of oxidizing the substance or of otherwise destroying it before it can do harm. This is the explanation of the fact that alcoholics and those who have the morphine habit are able to tolerate doses which would kill an ordinary man. In other words, their cells have had their oxidizing powers greatly increased by training. Again, in some manner which we do not understand, cells of the body possess the power of becoming accustomed to the presence of a given substance, provided its amount at first is not so great that the cell is destroyed at once. How this is accomplished we do not know. In some instances, particularly if a chemical compound be organic and of the nature of a protein poison, the cells protect themselves by producing antitoxin. (See Antitoxin.) So far as we know, antitoxins are not formed to combine with ordinary chemical compounds.

Conversely, the chemical constitution or function of a cell may render it especially susceptible to a given agent, in that its component part or parts have an affinity for one or all of the molecules forming the compound, as in the case of ether and chloroform, which combine with the lipoid or fatty portion of the cells of the higher nervous system and cause anesthesia.

In other instances, a cell suffers not because the agent primarily is deleterious, but because the cell stores it until its quantity renders it poisonous in effect. So, too, cells may be affected because the compound hydrates or dehydrates, solidifies or liquefies them, or they are influenced by the drug because it dissolves out some essential constituent, as, for example, cholesterin or lecithin. The process of hydration or dehydration is usually due to the fact that a given substance possesses hygroscopic properties, as glycerin, for example, or it results in obedience to the law of osmosis. Thus, if the proportion of salts in a fluid surrounding a cell is identical with the proportion of the salts in a cell, no change occurs; that is, the fluid and the cell contents are isotonic. If the proportion of salts in the fluid is less than that of the cell (hypotonic), it abstracts salt from the cell until the content of cell and fluid is identical; whereas, if the salt content of the fluid is in excess (hypertonic), the fluid passes out of the cell until the proportions in cell and fluid are equal or isotonic. Certain substances which in themselves are practically of little power may, therefore, act as very powerful agents because of their dilution or concentration. Thus, sulphate of magnesium, given in strong solution to a patient with dropsy, causes profuse watery dejections because, being highly concentrated, it causes the dehydration of the water-logged tissues, the fluid in which pours into the bowel to make the magnesium solution as dilute as the juices of the body. If, however, the magnesium solution is not concentrated and the patient is lacking fluid because of prolonged thirst, the magnesium salt may be absorbed into the blood and produce poisonous effects.

Again, certain cells have so-called receptors, or handles, by which they become attached to the drug, which thereby influences them. This is particularly true in the case of complex protein poisons, as the toxin of diphtheria or tetanus, for example, and it is also a fact in the case of many chemical compounds made synthetically. (See below.) Indeed, according to some investigators, the action of morphine in causing sleep is due to the fact that the cells of the brain possess receptors for it just as the cells of the anterior cornua of the spinal cord possess receptors which unite with strychnine. It is doubtful if this is true, however, as to ordinary alkaloids.

The structure of the cell, anatomical or chemical, renders it susceptible to certain substances. This is illustrated by the fact that methylene blue stains axis cylinders and sensory nerve-endings, whereas it fails to stain motor nerve-endings. Furthermore, certain cells are not stained by a given dye in health, but are stained when diseased, and it is well known in practical therapeutics that there is a great variation in the effects of remedies upon cells in health and disease. Mercury when given in syphilis is deposited freely in tissues affected by the disease, whereas in the non-syphilitic it is not freely deposited in tissues of a similar type.

The result of all these influences is that cells may be altered in function; that is, stimulated, depressed, or perverted. They may also suffer organic changes which result in temporary arrest of function or in death.

Last of all, it must be recalled that the susceptibility of cells depends, in many instances, solely upon their vitality, for many substances which affect living cells fail to affect or enter dead cells, and *vice versa*. This is probably due to some change in the anatomical or chemical construction of the cell, and in some instances it is probably due to the presence of oxygen in or about the living cell. Thus, paraphenylenediamine when injected into the blood deeply stains brown the central tendon of the diaphragm, the muscles of the eye, larynx, and tongue. This is because the cells in these areas are so highly endowed with bloodvessels that they contain an excess of oxygen, and not because the cells have any special predilection for the dye. Ehrlich believed that susceptibility is also influenced by the chemical environment of the cell, not only as to oxygen, but as to the alkaline and acid reaction.

It is seen, therefore, that the cell doctrine gave us our first clear conception of vital function, and that it, with the study of the functions of special aggregations of cells, or cell physiology, has led us to the understanding of the physiological effect of many remedies.

It is evident that a medicinal substance may exert an influence on the body in many different ways. First, it may act in its original form upon those cells of the body which have a special affinity for it, or, on the other hand, it may be inactive until it is split up in the body into two or more of its component parts, one or all of which act on one variety of cells or on different varieties of cells. This is illustrated when we administer potassium bromide, potassium iodide, or potassium cyanide, for in the body the bromine, iodine, or cyanogen is set free and acts powerfully; whereas the potassium base produces little or no effect. Much depends upon the readiness with which this breaking up occurs. Some compounds soon split up *in toto*, whereas others give up but little of their active component. Thus, in the case of iodoform the proportion of iodine readily liberated is 96.6 per cent; that of iodol, 50 per cent; that of europhen, only 28.5 per cent.

Again, the various component parts of a drug may be dissociated, and then form a new compound or compounds which produce a physiological effect not possessed by the substance as originally given. In the case of methenamine, commonly called urotropin, the therapeutic effect of the drug is not exercised as such, but as formaldehyde, which is excreted in many secretions, acting as an antiseptic. In other instances, such dissociation having taken place, one or more of the component parts unites with some substance which exists in the body and forms a new and active compound.

Furthermore, the readiness with which a drug is dissolved or broken up in the organism greatly affects the quickness and severity of its influence. As illustrative of this fact we find that phenacetin and acetanilid do not act as such, but only after they have become changed into paramidophenol by oxidation, and as phenacetin undergoes this change more slowly than acetanilid, it is less powerful as a drug and less active when given in poisonous dose.

Perhaps no better illustration of the activity of a drug, depending upon the readiness with which it is dissolved and broken up in the body, can be cited than the members of the nitrite group, in which amyl nitrite acts instantly, nitroglycerin acts a little more slowly, nitrite of sodium and nitrite of potassium still more slowly, and erythrol tetranitrate more slowly than all the others. In each instance the action is identical in kind, but different in degree, because of the chemical stability of each compound. Conversely, it is to be recalled that many substances which possess a chemical formula indicative at first sight of great physiological power are nevertheless inert because they are so stable that they are not broken up in the body, as, for example, ferrocyanide of potassium, in which neither the iron nor hydrocyanic acid exercise any effect because, although the latter is by itself a deadly poison, the chemical compound is indissoluble in the body.

At one time it was thought that there might be a definite relationship between chemical constitution and physiological action, but this has proved incorrect, so far as universal application is concerned. It is, however, possible by changing the chemical formula of a substance to greatly alter its physiological influence, not only in degree, but in kind, and to such an extent that it will no longer affect one part of the body, but will influence parts which, in its original form, it did not touch.

There is not space to discuss this in detail, but the following illustrations will suffice. Caffeine, which is trimethylxanthine, increases the functional activity of the heart, the respiratory center, the brain, and the muscles, and possesses a moderate stimulant effect on the kidneys; whereas, theobromin, which is dimethylxanthine, that is, contains one less methyl molecule, has little effect upon any part of the body except the kidneys, which it powerfully stimulates. So, too, propyl alcohol (C_3H_7OH) is more narcotic than ethyl alcohol (C_2H_5OH) and ethyl alcohol is more narcotic than methyl alcohol (CH_3OH), the addition of one molecule of carbon and two of hydrogen in each instance increasing the power of the compound. In the celebrated research of Baumann and Kast they found that sulphones not decomposed in the body are inactive, and that those which are decomposed when combined with one or more methyl groups are likewise inactive; whereas, if one or more ethyl groups are substituted they become powerful hypnotics, as sulphonal, trional, and tetronal.

Progress along another line resulted from a recognition of the fact that many of the disorders of function in the body, and actual disease, came about because of the presence, within or without, of hitherto undreamed of particles of protoplasm or cells, now called microörganisms, or bacteria, or parasites, which directly, or by producing poisons during their life or after their death, destroyed the cells of the body of man as completely as more manifest destructive agents. With this discovery it became clear that the function of the physician was to aid the patient in combating or withstanding their attacks, and also to destroy these malign agents if possible. In other words, it was learned that the aggregation of cells called the living body was aligned in disease against an aggregation of other cells, or invaders, or parasites, that sought to live by preying upon that body.

Having made these discoveries and having observed that many men and animals recovered when attacked by bacteria or other parasites, it became evident that the aggregation of cells called the body must be, in many instances, capable of protecting themselves against its enemies, and it became the duty of the investigator to discover what these protective methods are. It was soon found that the juices of the body and particularly the secretions or products of certain tissues, as, for example, the blood-serum and lymph, destroyed and dissolved invading germs or parasites (bacteriolysis); that certain cells of the body, notably certain of the white blood cells, surrounded, or swallowed, certain germs and devoured them (phagocytosis) (see Vaccine Therapy), and that a barrier of lymph and cells, which rapidly became organized into tissue, walled off the seat of invasion from the rest of the body. Further, that the lymph nodes are designed to provide forts or outworks in which hosts of devouring white cells battle with invading parasites that get so far. It was found that the cells of the body produce some substance or substances, as yet not isolated, which render invading parasites unable to cope with the phagocytes or white cells (opsonins). These facts having been determined, it was soon discovered how the physician can stimulate these protective processes to increased activity, as is shown in the text of this book later on. (See Vaccine Therapy.)

It was also noted that certain animals were immune to the action of certain microörganisms or their poisons which destroyed man, and, therefore, it became evident that such animals must be an unfavorable site for their growth; that is, possessed of the power of destroying the invading germs or parasites, or of antidoting the poisons they produced after they gained access to the body. The idea then followed that by injecting the blood serum of an immune animal into a living body not immune, some of the immunity of the animal could be conferred on the man, and this proving true the first step in antitoxin treatment of disease was taken.

The sum of all this advance is that at present we can aid the body in its endeavor to live by increasing bacteriolysis, by rendering the germs easy of slaughter by the white cells (Vaccine Therapy), and by stimulating the cells of an immune animal to increased activity we produce an antidote to bacterial or other toxins. (See Antitoxins.)

So far we have considered only the measures by which the body can be aided so that it will directly or indirectly combat the attack of parasites or their effects. It still remains to discover what can be done to destroy such parasites by giving remedies which will, because of the peculiarities of the protoplasm of these invaders, be able to destroy them without destroying the cells of the host. Until recently it was found that any substance capable of destroying the life of the protoplasm of the invader destroyed the more highly specialized and vitalized protoplasm of the man or animal.

It is manifest that if certain drugs have a special affinity for certain cells in the body, it is probable that there are discoverable substances which will have a special affinity for invading parasites, and by attacking them exclusively, destroy them alone. To the task of obtaining these substances Ehrlich and his co-workers set themselves, with brilliant results. Ehrlich started out with the hypothesis that for any substance to act upon a cell it must become intimately connected with it or fixed in it, and that this fixing, or marriage of the cell and the substance, can only take place by virtue of the fact that the cell has a receptor, or hand, by which it may be attacked or grasped. The receptor which takes the chemical substance is called a chemoceptor. It follows, therefore, that only those cells which have a receptor fitted to grasp a given chemical agent can be affected by it. On this basis he sought to find drugs which would unite with the protoplasm of an invading parasite, but be unable to damage the body cells, since they would have no receptors by which the poison could attach itself to them; that is, substances that would be parasitotropic and not organotropic. Further than this, he believed, and he proved, that not only a single substance could be so used, but that if he formed several groups of chemical substances into one fairly firmly connected compound, the cell of an invading parasite, by having a receptor for only one group, would nevertheless fall a victim to all the members of the group, although all the other members of the group might have been unable to unite with the cell if by themselves. It is as if several thieves who could not gain the confidence of a householder, finally joined together with another thief, who could worm his way into the householder's confidence, and having done so, permit the others to prey upon him; or, to use Ehrlich's own terms, the compound may be likened to a dart, the tip of which enters the body and the shaft of which connects the farther end laden with poison with the wound. Thus, in the case of arsphenamine, described below, which is dioxydiamidoarsenobenzol, the excess of the orthoamidophenol fixes the drug to the parasite, and so the trivalent arsenic group is enabled to reach the arseno-receptor of the cell of the spirochæta. But the beneficial effect does not stop here, for the destruction of the parasites results in the formation of antibodies, which also destroy any spirochætæ which may have escaped. If, however, the dose of the drug is too large so many parasites may be destroyed that the patient is overwhelmed by the poisons of their dead bodies.

Ehrlich's theory has recently been questioned and the idea advanced that there is some chemotropic substance in the parasite which combines with the drug.

There is not space to describe in detail Ehrlich's work, but, beginning with the parasite known as the trypanosome, Ehrlich tried the effect of various compounds, and found that those of the benzidine series destroyed it, particularly one which is red in hue and which he called, in consequence, "Trypan Red." Unfortunately this dye, although it destroyed the trypanosome, also destroyed the host of the parasite. He also found that atoxyl destroyed this parasite, and while less toxic to the host than trypan red, still was deleterious because the cells of the optic and acoustic centers contained chemoceptors for this compound. His next endeavor was to produce a compound which would combine with the receptor of the trypanosome, but with none of the cells of the host, and after a time produced arsacetin, which was nevertheless capable of being united with some of the cells of the host. After making 418 compounds, he obtained arsenophenylglycin, which was still less hurtful to the infected animal, but yet toxic to a small degree. This compound not only killed trypanosomes, but spirilla, as those of relapsing fever and chicken spirillosis. Next, he produced, as his six hundredth and sixth product, "606," which not only acts on the parasites named as well or better than its predecessors, but destroys the Treponema pallidum or parasite of syphilis. This compound, dioxydiamidoarsenobenzol, has little toxic power over the body, but is not entirely innocuous, and since then Ehrlich has improved it in this respect, producing neoarsphenamine "914" (see Part II), a compound which is not quite harmless to man, but possessed of an extraordinary affinity for the parasite of syphilis; so great an affinity that one large dose may be capable of destroying every spirochæta in the body of an animal. Unfortunately one dose is rarely sufficient in man in part because it is not given early enough after infection. Ehrlich stated that if iodine is introduced into arsphenamine it increases its effect on spirochæta of syphilis and diminishes its effect on trypanosomes, so that by varying the chemical constitution of a compound it may be made more specific. Ehrlich's work has, therefore, given us a specific remedy for syphilis, yaws, relapsing fever, African sleeping-sickness, and holds promise of much more. It could not have been accomplished without the knowledge of the cells of the body, the advances of bacteriology and chemistry, or without his extraordinary ability and training.

These facts show that therapeutics, with many other branches of medical learning, has emerged from pure empiricism into scientific accuracy, and stimulate us to aid in the advance and in the practice of accurate methods of treatment.

THE LIMITATIONS OF THERAPEUTICS.

It is of vital importance that the physician should also bear in mind the physiology and pathology, or abnormal physiology, of the various organs that he is called upon to treat. By doing so he will clearly recognize that failure to get the results he desires may be inevitable and in no way casts doubt upon his judgment as to the use of the remedy or upon its ability to do good, if this is possible. Because of the remarkable reparative processes of the body, particularly in the young, results can often be obtained which the devotee of the autopsy table believes to be impossible. Such a devotee is not a student of abnormal or perverted physiological function, but of morbid anatomy. Perverted function may arise from disordered action or actual organic change which in turn may be beyond relief. As a rule, cases of perverted function dependent upon no permanent organic change give the best results. It is therefore of the greatest importance that as clear a conception as possible of the state of an organ be obtained before one attempts to place a value upon a remedy which is seemingly indicated. Thus in a case of cardiac failure due to valvular lesions, digitalis may give the most brilliant results because the heart muscle is not in many cases diseased but only weary. In another instance digitalis may woefully fail because the myocardium is so degenerated that there is little normal heart muscle to be influenced. Again, we have the problem of the value of arsphenamine in syphilis. This drug undoubtedly kills the parasite of the disease but we have no right to expect it to clear up the damage already produced by the existence of the parasite in the tissues for months or years. There is no more reason for condemning 606 under these conditions than there is in expressing the belief that water is useless in the presence of a fire, because while it puts out smouldering embers it is unable to rebuild the partly destroyed building. In each instance more damage may be done by the water or the drug than the fire or disease induced. There are limits, in other words, as to what we can do by remedial measure as there are limits to every other line of human endeavor. Quinine may destroy the parasite of malaria just as 606 destroys that of syphilis, but in one sense both drugs are rather prophylactics than curative agents, because they utterly fail to correct the lesions which the parasites have induced. In other cases the toxin of one of the acute infections produces a perversion of function or an actual lesion which completely nullifies the usual effects of a remedy. The limitations of therapeutics are therefore not so much the results of impotency on the part of remedies as they are due to the fact that irremediable degeneration have occurred.

DIRECT AND INDIRECT ACTION OF DRUGS.

Drugs act in two ways, which are sometimes called near and remote, direct and indirect. The near, or direct, action of a drug is that influence which is felt by the exercise of its effect directly upon the tissues with which it comes in contact; the indirect, or remote, influence is that result which comes as a sequence of its primary effect. As an illustration of this we may take the local use of cantharides. The local, near, or direct effect of this is a blister; the remote or indirect effect is the absorption of exudates or the influencing of inflammatory processes. If a purge is used, its direct effect is the purgation which ensues, while its indirect effect is the relief of dropsy through the removal of transudate.

MODES OF ADMINISTERING DRUGS.

Drugs may be administered for the purpose of affecting the general system in many ways, but practically we employ only nine methods, as follows:

1. By the mouth or stomach.
2. By hypodermic injection.
3. By intravenous injection.
4. By intramuscular injection.
5. By inhalation.
6. By the rectum.
7. By inunction.
8. By fumigation.
9. By sublingual medication.

By the Mouth.—By far the most usual manner of administering drugs is by way of the mouth, which is the natural means of entrance into the body for foreign substances. Whenever medicines are used in this way the physician should clearly bear in mind what the medicine is to do after it is swallowed. If the drug is intended to act directly upon the stomach, it should not be given after meals, but some time before, since the food and gastric juice may afterward so cover the gastric mucous membrane that the medicament cannot act upon it. Thus, in a case of chronic gastric catarrh or gastric ulcer, the remedy used to affect the ulcer should always be given half an hour or an hour before meals. On the other hand, if an ulcer or other trouble exists in the small intestine, the drug should be given some time after meals, and if a heavy meal is taken, four or five hours after, since under these circumstances the medicine is swept out into the intestine almost at once, without remaining any time in the stomach, where it may be chemically altered. Very often it is necessary to give a medicine soon after food is taken in order that it may not act in too powerful or concentrated a manner upon the viscus which receives it or upon the general system by reason of its rapid absorption in concentrated form.

The general rule, however, may be laid down that all medicines are to be taken after rather than before meals, unless a local gastric effect or very rapid absorption is desired.

It is worthy of note that soluble tablets or drops placed under the tongue are absorbed almost as rapidly as if given hypodermically. This is called "sublingual medication."

By Hypodermic Injection.—Next to the use of drugs by the mouth, by far the most popular method is their administration by means of the hypodermic needle and syringe. The logic of this method rests upon the absorption of all soluble substances from the subcutaneous tissues with great rapidity. Any substance soluble enough or suspendable enough to pass through a hypodermic needle without forming an obstruction may be employed, provided it is not too irritating and that it is "clean."

The proper places to give such injections are the forearm, on the extensor surface,[1] the deltoid area of the arm, the abdominal wall, over or into the pectoral muscles, or the broad of the back—in other words, any spot where the tissues are not dense and unyielding. The skin of the part is to be grasped or pinched up with the thumb and forefinger of the left hand and the needle sent well into this raised fold, preferably above the finger and thumb, so that the pressure of the fingers may prevent pain and hold the part steady. The needle should always penetrate well into the loose connective tissue, so that the liquid injection may find lodgment in the relaxed and spongy subcutaneous tissues without separating the skin from its rather close adhesions to the tissues below or from the bloodvessels supplying it, for if separation occurs abscess and a slough may result.

The dangers from hypodermic injections are chiefly two. First: The needle may enter a vein, and the entire dose be carried at once, *en masse*, to the vital centers. Second: The solution or needle used may not be sterile, and an abscess result. The first danger is to be avoided by injecting into parts not well supplied with veins, and the second by thoroughly washing both syringe and needle with alcohol and then with sterile water the instant before they are used. The solution injected should be prepared by using freshly boiled water. Most physicians now make a solution for immediate use by adding a small tablet of the required drug to 20 minims of water at the moment it is needed or resort to ampoules containing a sterile solution of the medicament. A third danger supposed to exist by some persons, but probably more feared than need be, is the injection of air into a vein with the medicament. It is well to see that all air is expelled from the syringe before making the injection. Most hypodermic syringes hold from 20 to 30 minims.

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[1] Hypodermic injection into the flexor aspect of the forearm often causes much pain in the hand by irritating temporarily the branches of the radial or ulnar nerves.

By Intravenous Injection.—The intravenous injection of drugs is rarely practised except in the use of arsphenamine or neoarsphenamine in the treatment of syphilis or of quinine in the treatment of malarial infection. Needless to state only substances capable of complete solution can be so used. If at all irritating in character the drug must be well diluted and if the bulk of the injection is large the solution should be warm. The injection must be given slowly. (See Intravenous Injection, Part III.) In adults such injections are nearly always given by the median cephalic or the median basilic veins in the arm. In young infants the injection by a vein in the arm is difficult and the great saphenous vein near internal malleolus or the longitudinal sinus is usually employed. (See also Intra-abdominal Injections, Part III.) The advantage of an intravenous injection is that it acts promptly and one is sure that a full effect of a given dose is obtained, whereas when a drug is given by the stomach or hypodermic needle much of the injection may be unabsorbed for

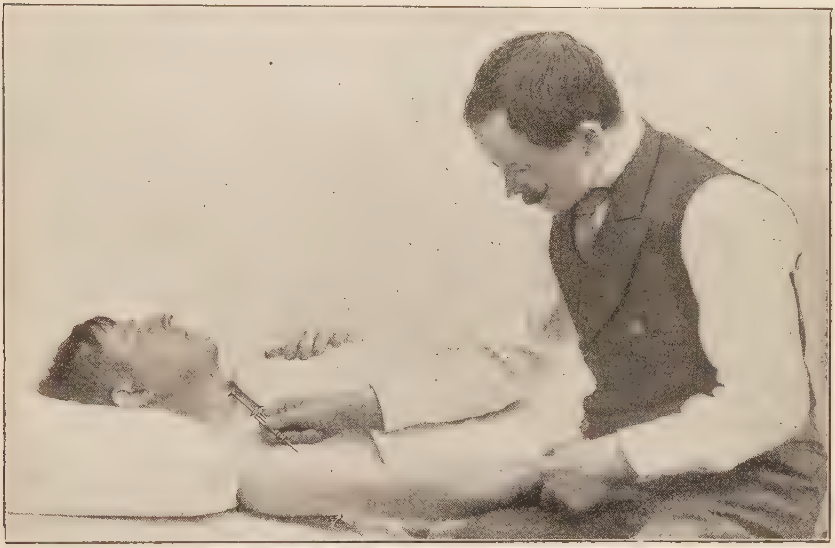

Fig. 1.—Method of giving a hypodermic injection. The skin having been sterilized, the needle is then pushed into the subcutaneous tissues, as shown in the illustration. If the injection is given into the forearm, the skin of the part into which the injection is to be given is to be raised by grasping it between the thumb and fingers of the left hand to aid in holding the forearm steady.

an indefinite period. In order to be sure that the needle is in the vein it is wise to slightly withdraw the piston of the syringe after the insertion of the needle to see if blood follows into the barrel.

By Intramuscular Injection.—Meltzer and Auer have shown that the rapidity of the absorption of a drug when given by the hypodermic needle is greatly increased if it be injected into the belly of one of the larger muscles. This rapidity of action almost equals that of an intravenous injection. Certain substances too irritating for hypodermic use are also given into the muscles. Before the injection is actually made it is proper to pull on the piston of the syringe. If blood appears the needle must be withdrawn and reintroduced as it is in a vein.

By the Rectum.—When drugs are given by the rectum, we employ them for three purposes: first, to influence the general system by their absorption; secondly, to act locally upon any disease which may be present in this particular locality or in the colon; and, finally, to dislodge substances or parasites which it is desired to bring away. The word "enema" is loosely used to denote all these injections, be their purpose what they may, and is synonymous with "rectal injection" or the more old-fashioned word "clyster." Sometimes these injections are called "lavements." If nourishment is being given, the injection is called a "nutrient enema." The efficiency of medication by the rectum depends greatly upon the character of the substance injected. When foodstuffs are given in this way, in all probability little more than their salts and fluids are absorbed. When very soluble alkaloids, such as strychnine sulphate is used, the absorption is very rapid and complete.

In this mode of administration it is very necessary that the physician should use the medicaments in proper bulk; and it may be laid down as a rule that no more liquid should be injected than is necessary to convey the medicine or food unless the injection is for the purpose of emptying the bowel of fecal matter or other materials, or it be desired to distend the bowel in order to overcome obstruction, or to influence the colon by drugs.

The reason for this lies in the fact that any large bulk of liquid sent into the rectum so stimulates the walls by distention as to cause spasmodic contraction, with expulsion of all the rectal contents, which is just what is needed when fecal matter is to be removed, but the opposite of what is desired when retention of a remedy or food is necessary for absorption or local action. In rectal catarrh or ulcers 2 to 4 ounces of liquid are usually sufficient in an adult to accomplish any medicinal influence locally or by absorption, while as a laxative enema one to two pints may be employed.

By the use of injections the rectum frequently becomes irritable, and resists all efforts to force the entrance of liquids or solids. This is to be avoided by giving the injection so gently that the bowel fails to recognize, as it were, the entrance of the liquid, and by introducing a few drops of oil and laudanum in each injection.

A large amount of distress often follows the gradual accumulation of fecal masses in the colon which are not passed with the daily movement of the lower bowel. These can readily be removed by large injections of warm water or oil or by the use of medicated liquids.

When a large quantity of water is used, it should be warmed to 100° F. or a little more, and it is well to add salt to it, so that it will represent the normal saline strength of blood-serum, namely, 0.9 per cent. (For use of injections in special diseases, see Part IV, and for Enteroclysis, Part III.)

Suppositories are another means by which medicines are introduced into the bowel, either for local effect or to act, after absorption of their contents, upon the general system.

By Inhalation.—When drugs are given by inhalation they are generally employed with the object of affecting the respiratory tract alone; notable exceptions are ether, chloroform, nitrous oxide gas, and other volatile substances. Aside from anesthetics are such remedial measures as the inhaling of steam laden with the drugs employed, the respiring of air charged with the fumes of the medicament, or the inhalation of gases, and last, and most commonly resorted to of all, the use of the vaporizer, which, if properly made and employed, so minutely divides the liquid containing the medicament that the inspired air carries it to the farthest bronchiole and pulmonary vesicle. (See Part III.)

As an example of the rules governing the administration of drugs in this manner we find that compound tincture of benzoin may be taken by inhaling the steam arising from hot water containing it, but cannot be used in a spray because it occludes the fine points of the atomizing tubes. In a similar manner the smoke of belladonna or tobacco leaves may be inhaled to relieve asthma, or the fumes of chloride of ammonium for bronchitis in its later stages. Fumigation with mercury, the sublimed vapor being inhaled, is also useful in syphilis. Finally, we find that oxygen is sometimes very useful, the gas being readily inhaled, with good results in proper cases.

The "spray" or atomizer is made in two forms—one form of apparatus being operated through the agency of compressed air, the other through the escape of steam from a small boiler. Very few of the compressed-air atomizers throw a spray sufficiently fine to reach the deeper parts of the lungs, particularly if the air is compressed by the hand; but all instrument makers now sell vaporizers or nebulizers which so minutely divide the liquid medicament that it readily enters the deeper parts of the lungs.

The inhalation of moist air is very useful in bronchitis, and greatly aids other remedial measures. Steam may be disengaged in a room by means of a kettle of boiling water or by placing pieces of unslaked lime in a pan of water.

By Inunction.—Inunctions consist in the rubbing into the skin of medicines, generally of an oily or fatty nature, or which assume this character through embodiment with oil or fat. Fatty substances are absorbed through the skin by way of the sebaceous glands, not through the epiderm, and, therefore, substances not fatty are but poorly absorbed when applied by inunction. The three substances most commonly used in this way are cod-liver oil, mercurial ointment, and iodine ointment. They should always be applied on some part where the derm is thin and well supplied with subcutaneous lymphatics, just below the axillæ, in the groins, or the insides of the thighs. Other substances have been and may be used by inunction; but as this method is necessarily a disagreeable and dirty one, it is rarely resorted to unless the stomach is disordered or it is necessary to cause absorption of the drug by every possible avenue of entrance.

The endermic method consists in the use of a blister, by means of which the epiderm is raised, when a little morphine or other alkaloid may be slipped under it and so absorbed through the true skin. It is a painful method, almost never to be resorted to, having been supplanted by the hypodermic method of medication.

Drugs are also sometimes caused to enter the body through the skin by placing them in plasters or poultices, or by the electrical process called cataphoresis.

PHARMACEUTICAL PREPARATIONS.

Remedies are administered in a number of forms, but chiefly as follows:

ABSTRACTS are dry powdered extracts mixed with sugar of milk until they are twice as strong as the crude drug. Abstracts are no longer official in the United States Pharmacopœia.

ACETA, or vinegars, are solutions of the active principles of drugs in vinegar or dilute acetic acid. There is one in the United States Pharmacopœia (*Acetum Scillæ*) and three in the British (*Acetum Cantharidini, Acetum Urginea* and *Acetum Scillæ*).

ALKALOIDS are organic bases, forming salts with acid radicals, generally occurring in crystalline form and abstracted from crude drugs. They nearly always represent the active principle of the drug.

AQUÆ, or waters, are used as vehicles either for the dilution of strong medicines or for the purpose of carrying minute amounts of flavoring materials.

CATAPLASMS are not official in the United States Pharmacopœia. They are virtually poultices made of linseed-meal or of bread-crumbs.

CERATES are ointments containing wax to render them harder than would ordinary fats.

CHARTÆ, or papers, consist of bibulous paper soaked in a solution of the drug which they are intended to carry.

CONFECTIONS are sometimes called electuaries or conserves, and are soft pastes which contain the drug mixed with sugar or honey.

DECOCTIONS are solutions of drugs made by boiling and then straining while hot.

ELIXIRS are sweetened alcoholic liquids rendered pleasant to the taste by the addition of aromatic substances and sugar.

EMPLASTRA, or plasters, are made up of adhesive substances placed upon a backing of cloth or leather and designed to adhere to the skin being so applied for the purpose of holding a medicinal substance in contact with the body, of acting as a protective, or of aiding in the approximation of the edges of a wound.

EMULSIONS are liquid preparations which consist of oily substances minutely subdivided and held in suspension in water usually by some gummy material.

EXTRACTS consist of the soluble parts of plants reduced to a semisolid or solid condition by evaporation; the soluble constituents being taken from the plant by water or alcohol.

FLUIDEXTRACTS are alcoholic solutions made in such a way that each cc. equals 1 gram of the crude drug.

GLYCERITA, or glycerites, are solutions of various substances in glycerin—the glycerin being used as a vehicle.

INFUSIONS are made by pouring boiling water on the crude drug and allowing it to stand for a short time until the water cools, after which the liquid is strained. Sometimes cold water is employed.

LINIMENTS are made of oily substances often mixed with powerful drugs to increase their efficiency.

LIQUORS are usually watery solutions of non-volatile drugs.

MIXTURES are composed of two or more drugs or of a single drug partly dissolved and partly in suspension.

PILLS are small round masses which, as a general rule, should not weigh more than 3 grains, in order to avoid too great bulk. If the material is a heavy one, as much as 5 grains may be placed in each pill. Pills may be without covering or coated with sugar or gelatin to preserve them and prevent the patient from tasting their contents. Sugar-coated pills must always be fresh and the sugar-coating pure. Gelatin is the best coating for pills. Many pills are fraudulently coated with varnish and are insoluble.

SPIRITS are alcoholic solutions of volatile substances.

SUPPOSITORIES are small masses made into a cone shape and having for their basis cacao butter. They are designed to carry into the rectum certain medicines for absorption into the system or for local action.

SYRUPS are solutions of sugar in water or in medicated aqueous liquids. They are used as vehicles.

TABLETS.—Under this name manufacturing pharmacists and others prepare compressed pills or lozenges, generally of small size, the mass being made to adhere by means of its being subjected to great pressure by special machinery. Smaller tablets are used for carrying powerful drugs for hypodermic use. These, however, are often only lightly pressed, so as to render them easily soluble.

Tinctures are solutions of the active principles of drugs in alcohol or in mixtures of alcohol and water.

Triturates are made by adding 10 per cent of the active medicine to 90 per cent of milk-sugar. These are then carefully rubbed together until the two are intimately mixed. Triturates are valuable in the administration of medicines to adults or to children. These triturates are often made into tablets, forming what are known as "Tablet Triturates."

Troches, or lozenges, are flat, hardened, medicated masses designed to be held in the mouth, so that they may be slowly dissolved, thereby affecting the local mucous membrane.

Unguenta, or ointments are unctuous preparations containing medicinal substances which melt at the temperature of the body.

Wines are made in the same way as tinctures—strong white wine being used in the United States, and sherry or orange wine in Great Britain, in place of ordinary alcohol.

WEIGHTS AND MEASURES.

There are two systems of weights and measures employed in the United States at the present time. The one most commonly used is the old-fashioned system of Apothecary weights for solids, and the Wine, or Apothecary, measures for liquids. The newer and more accurate system is that known as the Metric, or Decimal system of weights and measures, which is now recognized and recommended by the Pharmacopœias of the United States, Great Britain, Germany, and France.

The divisions of Apothecary weights are the pound, the ounce, the dram, the scruple, and the grain. The scruple, which equals 20 grains, has dropped out of use, chiefly because the scruple mark when written somewhat resembles that of the dram. We may say, therefore, that the Apothecary weights consist of a pound, equalling 12 ounces, or 96 drams, or 5760 grains; that the ounce represents 8 drams, or 480 grains; and that the dram equals 60 grains. The abbreviation for the word grain is "gr."; for the dram, ʒ; for the ounce, ℥; and the pound ℔.

In the Wine, or Apothecary, measures we have the gallon, the pint, the fluidounce, the fluidram, and the minim. In each gallon there are 8 pints, 128 fluidounces, 1024 fluidrams, and 61,440 minims. In each pint there are 16 fluidounces, 128 fluidrams, and 7680 minims. In each ounce there are 8 fluidrams and 480 minims. In each dram there are 60 minims. The abbreviation of the Latin word "minimum" or "minim" is ♏; of the fluidram, fʒ; of the fluidounce, f℥; of a pint, or "octarius," O; and of the gallon, or "congius," Cong.

The British Pharmacopœia has adopted the Avoirdupois system of weights, and thereby has a system which differs somewhat from the Apothecary weights of the United States Pharmacopœia. The Avoirdupois pound represents 16 ounces, or 7000 grains; the Avoirdupois ounce, 437.5 grains. It will be seen, therefore, that the Apothecary pound contains 1240 grains less than the Avoirdupois pound, but that the Apothecary ounce contains 42½ grains more than the Avoirdupois ounce. Fortunately, however, the grain, both of the Apothecary and Avoirdupois systems, is of identical value. So, too, the British Pharmacopœia uses what is known as the Imperial system of measures in place of the Wine measures used in the United States. Thus, the Imperial gallon represents 8 pints, 160 fluidounces, 1280 fluidrams, and 76,800 minims; the Imperial pint, 20 fluidounces, 160 fluidrams, and 9600 minims; and the fluidounce, 8 drams or 480 minims. The fluidram equals 60 minims. It will be seen, therefore, that the Imperial measure differs from the wine measure chiefly in having 20 fluidounces in each pint, instead of 16. So, too, the weight of the Imperial fluidounce contains the same number of grains as the Avoirdupois ounce, which is 18.2 grains less than the weight of the United States fluidounce, which is 455.7. These differences between the weights and measures used in the United States and Great Britain are, therefore, of little importance when we are employing grains or minims, but they become of great importance when we employ ounces, and of still greater importance when we employ pounds or pints. In the average prescription, however, which rarely exceeds 3 or 4 ounces, the difference in quantities in the United States and Great Britain are not of very great importance.

The advantages of the metric system over these irregular systems of weights and measures are the same as those of the decimal system of currency over the English system of pounds, shillings and pence. The unit of all calculations is the meter, which in the metric system is the unit of length. From this is derived the unit of capacity, the liter, which is the cube of one-tenth of a meter; and from the liter is derived the unit of weight, the gram, which is the one-thousandth part of the weight of a liter of distilled water at its maximum density. As a matter of fact, the metric system is no more difficult to master than is the system of dollars and cents. The great difficulty is that the majority of physicians have learned the doses of various preparations in the Apothecary weight find it difficult to begin using the metric system, and do not take the trouble to convert the Apothecary doses into this system.

In the metric system we have the gram (Gm.) which may be said to be the equivalent of the dollar; the decigram, or one-tenth of a gram, which represents the dime; the centigram, or one-hundredth of a gram, which represents the cent; the milligram, or the one-thousandth of a gram, which represents the mill. Above the gram in quantity we use what is known as the decagram, which corresponds to the gold eagle, or ten dollars; the hectogram, which corresponds to one hundred dollars; and the kilogram, which corresponds to one thousand dollars. When we come to the use of the metric system for fluids, we use as the unit the milliliter, called the "mil.," or cubic centimeter (cc.) in place of the gram; a mil., or cubic centimeter, representing 1 fluidgram.

When it is wished to convert grains into their metric equivalent, it must be remembered that 0.065, or 65 milligrams, is the equivalent of 1 grain. Therefore, the following examples may be used:

3 grains are equal to 3 × 0.065 = 0.195 gram.
60 grains are equal to 60 × 0.065 = 3.9 grams.[1]
$\frac{1}{4}$ grain is equal to $\frac{1}{4}$ of 0.065 = 0.0162 gram.
$\frac{1}{100}$ grain is equal to $\frac{1}{100}$ of 0.065 = 0.00065 gram.

To convert grams into grains, instead of multiplying by 0.065, we divide, thus:

Gram 0.12 is equal to 0.12 ÷ 0.065 = 1.8 grains.
Grams 3.9 are " " 3.9 ÷ 0.065 = 60.0 grains.
Gram 0.06 is " " 0.06 ÷ 0.065 = 0.9 grain.
Gram 0.0006 is " " 0.0006 ÷ 0.065 = 0.0092 grain.

When we wish to convert Apothecaries' drams into grams, we multiply the number of drams by 3.9, or, more commonly, though less accurately, by 4.0. Thus:

10 drams × 4.0 = 40 grams, or, more accurately,
10 drams × 3.9 = 39 grams.

When grams are to be converted into drams we divide the number of grams by 3.9, or approximately 4.0. Thus:

10 grams ÷ 3.9 = 2.56 drams, or, less accurately,
10 grams ÷ 4.0 = 2.5 drams.

When Apothecary ounces are converted, we multiply by 31.1; or if grams are to be converted into ounces, we divide by 31.1. Thus:

2 ounces × by 31.1 = 62.2 grams.
40 grams ÷ by 31.1 = 1.25 ounces.

As accurate translation of Apothecaries' weights into the metric system leaves a fractional quantity in almost every instance, and as the translation of the metric system into Apothecaries' weights does likewise, the author has for the sake of presenting even figures, and therefore rendering the interchange practicable, considered that the Apothecary ounce and the fluidounce are equal to 30 grams or 30 mils. or cubic centimeters, although a more accurate estimate of the ounce is 31.1 and of the fluidounce is 29.57.

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[1] Usually considered as 4.0.

TABLES OF RELATIVE WEIGHTS AND MEASURES IN THE METRIC AND APOTHECARIES' SYSTEMS.

(See Oldberg's Manual of Weights and Measures.)

MILLIGRAMMES IN GRAINS.

Milligramme.		Grain.	Milligrammes.		Grain.	Milligrammes.		Grain.
0.1	=	$\frac{1}{600}$	1	=	$\frac{1}{60}$	8	=	$\frac{1}{8}$
0.2	=	$\frac{1}{300}$	1.2	=	$\frac{1}{50}$	9	=	$\frac{1}{7}$
0.3	=	$\frac{1}{200}$	1.6	=	$\frac{1}{40}$	10	=	$\frac{1}{6}$
0.4	=	$\frac{1}{150}$	2	=	$\frac{1}{30}$	12	=	$\frac{1}{5}$
0.5	=	$\frac{1}{120}$	3	=	$\frac{1}{20}$	16	=	$\frac{1}{4}$
0.6	=	$\frac{1}{100}$	4	=	$\frac{1}{15}$	20	=	$\frac{1}{3}$
0.7	=	$\frac{1}{90}$	5	=	$\frac{1}{12}$	30	=	$\frac{1}{2}$
0.8	=	$\frac{1}{80}$	6	=	$\frac{1}{10}$	60	=	1
0.9	=	$\frac{1}{70}$	7	=	$\frac{1}{9}$			

CENTIGRAMMES IN GRAINS.

Centigrammes (or Cent.)		Grain.	Centigrammes. (or Cent.)		Grains.	Centigrammes (or Cent.)		Grains.
1	=	$\frac{1}{6}$	6	=	1	18	=	3
2	=	$\frac{1}{3}$	7	=	$1\frac{1}{3}$	25	=	4
3	=	$\frac{1}{2}$	9	=	$1\frac{1}{2}$	50	=	8
4	=	$\frac{2}{3}$	10	=	$1\frac{2}{3}$	75	=	12
5	=	$\frac{5}{6}$	12	=	2	100	=	16

GRAMMES IN GRAINS.

Grammes.		Grains.	Grammes.		Grains.	Grammes.		Grains
0.001	=	$\frac{1}{60}$	11	=	176	27	=	432
0.010	=	$\frac{1}{6}$	12	=	192	28	=	448
0.100	=	$1\frac{2}{3}$	13	=	208	29	=	464
0.250	=	4	14	=	224	30	=	480
0.500	=	8	15	=	240	31	=	496
0.750	=	12	16	=	256	32	=	512
1	=	16	17	=	272	33	=	528
1.50	=	24	18	=	288	34	=	544
2	=	32	19	=	304	35	=	560
3	=	48	20	=	320	36	=	576
4	=	64	21	=	336	37	=	592
5	=	80	22	=	352	38	=	608
6	=	96	23	=	368	39	=	624
7	=	112	24	=	384	40	=	640
8	=	128	25	=	400	50	=	800
9	=	144	26	=	416	100	=	1600
10	=	160						

Cubic Centimetres (or Fluidgrammes) in U. S. Apothecaries' Fluidrachms.

Cc.		U. S. Fluidrachms.	Cc.		U. S. Fluidrachms.	Cc.		U. S. Fluidrachms.
1	=	¼	9	=	2¼	16	=	4
2	=	½	10	=	2½	20	=	5
3	=	¾	11	=	2¾	24	=	6
4	=	1	12	=	3	28	=	7
5	=	1¼	13	=	3¼	32	=	8
6	=	1½	14	=	3½	48	=	12
7	=	1¾	15	=	3¾	64	=	16
8	=	2						

Table of Approximate Percentages.

To make—	Grains per Fluidram.	Grains per Fluidounce.	Grains per Fluidpint.
1 per cent.	0.60	5.	73.
2 "	1.15	9.15	146.
3 "	1.70	14.	219.
4 "	2.30	18.25	292.
5 "	2.85	23.	365.
6 "	3.40	27.50	438.
7 "	4.	32.	511.
8 "	4.60	36.50	584.
9 "	5.15	41.	657.
10 " .	6.	46.	730.

Based on 57 min. to the drachm, 457 min. to the ounce, and 7300 min. to the pint.

DOSAGE.

No one can practice medicine for more than a very brief period without becoming convinced that quite as much skill is required on the part of the practitioner in determining the dose which is needed of a given remedy as in deciding upon the remedy itself. The very fact that an individual is seriously ill, with resulting impairment of vital functions, may make him very sensitive to the influence of doses taken with impunity by the same person when in health. In other instances the malady may render him very tolerant of a drug and he may need a dose larger than the ordinary one to get an effect. It repeatedly happens that one physician fails to produce the desired results, while another physician immediately gets good effects from the same remedy for no other reason than that he has been more skilful in determining the amount which should be administered and the frequency of its administration.

In teaching medical students the dose of remedies it is impossible to do more than inform them of the approximate doses. Only experience can tell the individual physician the amount which will be needed in a given case, and often even those with the largest experience have to try several doses before they find the one which produces the effects they desire. These facts have much to do with the contradictory ideas which exist in different men's minds as to the efficiency of a given remedy. One physician states that he frequently employs a certain drug and has come to rely upon it as a "sheet-anchor" when conditions are desperate; another physician replies that he has tried it, and that his results have been as lacking in success as the other's have been full of good. This difference of opinion does not rest upon any lack of power of observation on the part of either man, but upon the judgment of each as to the amount of the remedy to be used. If there were more accurate statements made as to the doses employed when remedies are suggested by one practitioner to another, better results would accrue.

It is also probably the case that certain physicians consistently administer remedies in doses which are too large, or which speedily become too large because the drug is one which is persistent in its effect, so that after a few doses the patient is not only under the influence of the remedy administered on that particular day, but also under the influence of doses which have been administered on previous days. Then there is the physician who habitually uses too small doses, and it may be that in a large number of cases he is a better practitioner than he who gives the large ones. Sometimes rapidly acting, but fugacious, remedies are given at too long intervals, or doses of slowly acting, persistent remedies are given too close together; and, again, sufficient judgment is not exercised in determining exactly what is to be accomplished in a given patient at a given time. Thus, in the administration of digitalis it is often wise to give one or two rather large doses, and almost always unwise to continue them, the proper method being to correct urgent symptoms by large doses and then maintain the good effect by smaller ones, thereby preventing an excessive digitalis effect, which may be more disagreeable or harmful to the patient than the condition for which the remedy is administered.

Another illustration of this is in the administration of alkalies for the purpose of aiding in the elimination of ketone bodies, and restoring the fixed bases in the blood, which induce or accompany diabetic coma. Sodium bicarbonate is given by rectal injection or by intravenous infusion, but in many instances the quantity of alkali which is given is quite insufficient to produce the results desired, because the physician does not estimate the degree of the acidosis. It is not at all uncommon for these ketone bodies to amount to as much as 10 to 20 grams in the twenty-four hours, and many instances are on record in which several times this quantity has appeared in the urine, which is an index of the total acidosis of the body. Manifestly different doses of alkali have to be used in such cases, and sometimes, instead of giving as much as a dram, or 4 grams, it is proper to give as much as 3 or 4 ounces of sodium bicarbonate in each twenty-four hours. Cases are on record in which as much as 900 grams, or 30 ounces, of sodium bicarbonate have been administered without neutralizing the urine. In other words, in this condition the alkali should be given for effect and not by weight, the principle governing its administration being more akin to the employment of an antidote in mineral poisoning, or the use of antitoxin in diphtheria, rather than to the adjustment of the dose of a drug ordinarily employed for the purpose of producing a physiological effect. On the other hand, if sodium bicarbonate is given too freely a state of alkalosis is developed.

For several reasons there is no absolutely fixed rule which can be applied to dosage. In the first place, the individual may not be readily affected by drugs, or the disease process present may so antagonize them as to render very large doses necessary. Further, the age and sex of a patient have much to do with the regulation of the proper amount of a drug to be employed. Finally, that curious but common condition of susceptibility to various remedies, that we call *idiosyncrasy*, creeps in as an important factor in the decision as to the dose which should be given in each case.

By far the nearest approach which can be made to absolute accuracy in dosage is to use drugs *according to the weight of the patient*, but this method possesses the disadvantage that we cannot always weigh our patients, and that the presence of a large amount of fat or of dropsy will make an unknown quantity in the calculation as to the true weight of the active part of the individual.

At present we are accustomed to be governed by a list of doses to be given to all adults within certain limitations, and which are varied sufficiently to permit of great differences in the effects obtained. It is in this very factor that the success of many a physician chiefly rests. The dose must be varied to fit the case in the same manner that the cut of a coat must be varied to fit each individual.

As already stated, there is not a uniform dose of all preparations of the same class, but it will aid the student to bear the following facts in mind: With a few exceptions the dose of solid extracts of nearly all the powerful drugs is about $\frac{1}{8}$ to $\frac{1}{4}$ grain (0.008–0.016); of fluid-extracts of nearly all powerful drugs about 2 to 5 minims (0.12–0.3); of aromatic oils and liquors containing powerful drugs about 6 to 10 minims (0.36-0.6); of tinctures of powerful drugs about 5 to 20 minims (0.3–1.3), except cantharides and iodine, the dose of which equals about 2 to 6 minims (0.12–0.36). Of official waters the dose is about 1 dram to 1 ounce (4.0–30.0), and of infusions and decoctions about 1 dram to 1 ounce (4.0–30.0).

There are a number of approximate rules in regard to the doses which are to be given in treating the diseases of children, the best of which is Young's rule. This is as follows:

Add 12 to the age and divide by the age. Thus, if a child is two years old, we have the following formula: $2+12=14\div 2=7$, or, one-seventh of the dose for an adult is the dose for a child of two years This rule is not a law, however, for of narcotics children should receive less than this (one-half), and of purgatives or laxatives more than this (two or three times).

When drugs are given hypodermically the dose should be generally one-half to one-quarter of that given by the mouth; and if any suspicion of idiosyncrasy exists, the dose should be smaller still at first if powerful remedies are to be used.

	Dropped from				Dropped from		
	Shop bottle.	Glass stopper.	Minim measure.		Shop bottle.	Glass stopper.	Minim measure.
Acetum lobeliæ	51	48	64	Oleum tanaceti	110	91	136
Acetum opii	66	57	65	Oleum terebinthinæ	103	90	142
Acetum sanguinariæ	102	92	92	Spiritus ammon. ar.	108	87	139
Acid. acetic.	82	49	101	Spiritus camphoræ	98	79	140
Acid. acetic. dilute	94	55	99	Spiritus æther. comp.	120	88	140
Acid. carbolic.	82	66	110	Spiritus æther. nitr.	88	86	144
Acid. hydrobromic.	57	65	70	Spiritus menthæ pip.	98	86	143
Acid. hydrochloric.	60	57	96	Syrupus scillæ comp.	106	87	122
Acid. hydrochloric. dil.	70	51	62	Tinctura aconiti	120	102	164
Acid. nitric.	82	66	124	Tinctura asafœtidæ	102	85	145
Acid. nitric. dilute	63	60	81	Tinctura belladonnæ	94	81	128
Acid. nitrohydrochloric.	87	74	92	Tinctura benzoini co.	98	81	146
				Tinctura cannabis ind.	124	120	98
Acid. nitrohydrochloric. dilute	58	54	62	Tinctura cantharidis	118	97	136
Acid. phosphoric.	54	43	62	Tinctura capsici	116	88	143
Acid. sulphuric.	160	152	172	Tinctura colchici	86	80	124
Acid. sulphuric. dilute	57	47	60	Tinctura digitalis	114	79	145
Acid. sulphuric. aromatic.	97	94	144	Tinctura ferri chlor.	108	. .	139
Aqua ammoniæ	45	41	54	Tinctura hyoscyami	114	91	147
Aqua destillata	64	. .	61	Tinctura ignatiæ	112	83	140
Liquor potass. arsen.	58	61	77	Tinctura iodi	112	97	144
Oleum anisi	76	73	112	Tinctura kino	116	100	148
Oleum amygdalæ amar.	102	77	75	Tinctura krameriæ	117	96	150
Oleum cari	108	84	133	Tinctura lavand. co.	97	86	141
Oleum chenopodii	94	75	129	Tinctura lobeliæ	110	79	138
Oleum carophylli	98	75	133	Tinctura myrrhæ	100	95	145
Oleum cinnamomi	77	73	112	Tinctura nucis vomicæ	112	105	148
Oleum crotonis	84	62	104	Tinctura opii	98	92	143
Oleum cubebæ	86	80	120	Tinctura opii camph.	94	86	135
Oleum gaultheriæ	93	93	136	Tinctura opii deodor.	109	89	141
Oleum hedeomæ	95	83	130	Tinctura rhei	98	82	144
Oleum lavandulæ	105	78	133	Tinctura sanguinariæ	110	88	134
Oleum monardæ	82	76	125	Tinctura stramonii	100	93	120
Oleum menthæ pip.	88	73	132	Tinctura tolutani	120	97	156
Oleum menthæ viridis	95	81	132	Tinctura veratri	108	98	152
Oleum myristicæ	98	83	128	Vinum aloes	71	54	94
Oleum origani	91	83	133	Vinum colchici rad.	92	72	95
Oleum pimentæ	102	86	133	Vinum colchici sem.	86	71	105
Oleum rosmarini	92	88	133	Vinum ergotæ	148	99	122
Oleum sassafras	83	77	142	Vinum opii	96	72	102

By the rectum the dose should be twice the amount given by the mouth, unless the drug be very powerful or capable of very rapid absorption.

When ordering liquid medicines in small amounts the prescription should always call for minims rather than drops, for the size of a drop varies with the particular liquid with which we are dealing and the shape of the mouth of the vessel containing it. Thus, if tincture of digitalis is measured it will be found that it takes 385 drops to fill a medicine glass to the 120-minims line. These variations are well shown in the preceding table, compiled by Kinsey, and originally published in the *American Journal of Pharmacy.*

Doses are also ordered in teaspoonful, dessertspoonful, and tablespoonful quantities. Sometimes they are given by the wineglassful, meaning by this term a sherry-glassful. Roughly estimated, a teaspoonful equals a fluidram (4.0), a dessertspoonful 2 fluidrams (8.0), and a tablespoonful ½ a fluidounce (15.5). As spoons and wineglasses vary considerably in capacity, it is always best to use a graduated medicine glass, such as is shown in Figs. 2, 3, and 4.

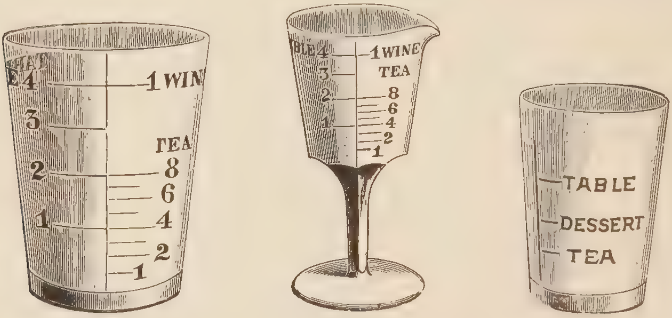

Fig. 2 Fig. 3 Fig 4

Figs. 2, 3 and 4.—Graduated medicine glasses.

ABSORPTION OF DRUGS.

Knowledge of the rapidity with which certain drugs are absorbed from the various surfaces with which they come in contact is of importance in order that we may know when to repeat the dose if the first amount does not produce the desired effect. The rapidity of absorption depends upon a number of factors.

Physiological Factors.—If the circulation is active, absorption is rapid; but if it be depressed, absorption is slow. Thus, in a person apparently drowned, absorption may not occur at all until the vital functions are restored, and repeated doses given to the patient while unconscious, acting together, may in the end poison him. This is often the case in delirium tremens when hypodermic injections of morphine are given or when the drug is administered by the mouth. In dropsy absorption is peculiarly slow, and a medicine may remain in the tissues for days, only to be absorbed with the transudate after severe purgation, profuse diuresis, or tapping. In cases of general dropsy hypodermic medication is nearly always worse than useless.

When the stomach or bowel is empty absorption from either is rapid, but when they are full it is very slow. In this fact we find the reason for the popular idea that a drink of whisky taken when a man is hungry makes him drunk, whereas twice that quantity after a meal does not do so.

Drugs in the stomach or bowel have no influence upon the general system unless they are irritants. They only act when taken into the blood or lymphatics. When the stomach is atonic and its powers of absorption impaired, the addition of some irritant or stimulant, such as capsicum, will often aid in the absorption of the necessary drug.

Physical Factors.—The physical characteristics of a drug greatly affect the rapidity of its absorption. Thus, the more volatile, diffusible, and soluble the medicament, the greater the speed with which it will enter the circulation. Two solutions belonging to the same group of chemical compounds may be utterly different in their action because of their physical state, as, for example, the volatile hydrocarbon pental, which is absorbed with great rapidity, and the non-volatile paraffin, which, although it belongs to the hydrocarbons, is entirely without physiological effect.

Alcoholic solutions of drugs are more rapidly absorbed than are watery solutions or those made with glycerin or milk.

DURATION OF ACTION OF DRUGS.

The duration of the action of drugs depends partly upon their rapidity of absorption, but chiefly upon the rapidity or slowness of their decomposition or destruction in the body and their elimination from it. Thus, volatile substances, such as ether, chloroform, and nitrite of amyl, act only for a short time and are quickly eliminated; whereas bromide of potassium and digitalis continue active during many hours, and are slowly eliminated, as in the case of the former, or oxidized, as in that of the latter. Again, if curare is given hypodermically it will cause paralysis, but if taken by the stomach in moderate amount it will be eliminated by the kidneys as rapidly as it is absorbed, and produce no effects if these organs are active.

So, too, if a patient's kidneys are healthy, very large doses of the potassium salts are harmless; but if he suffers from nephritis so that the potash is not rapidly eliminated they become dangerous depressants and may induce dropsy.

From studying the duration of the action of a drug we learn how often to order a dose. Thus, digitalis may be given once, twice, or thrice a day, but carbonate of ammonium must be given every two or three hours to maintain its effects.

When the physician is not careful in the use of a potent drug which is eliminated slowly, it may suddenly develop so severe an effect as to cause alarm, owing to its accumulation in the body. This is called "cumulative action."

COMBINATION OF DRUGS FOR JOINT EFFECT.

The study of the physiological action of drugs has aided very greatly in improving our therapeutic measures. Thus, we now know that chloral is a heart depressant and cannot be used in very full doses, or pushed to produce sleep in persistent insomnia, without grave danger; whereas morphine, which also produces sleep but does not depress the heart, but does depress the respiration, can be combined with it, and the two acting together, each in small dose, produce a heavy sleep, although so little chloral is present that the heart is safe, and so small an amount of morphine is used that the respiration does not suffer.

Another example of this is found in certain purgative pills in which the purgative agent is assisted by belladonna and nux vomica, the first of which relaxes muscular spasm, while the second acts as a tonic to the alimentary tract, the drugs combining to accomplish one result.

Skill in the combination of drugs, not only for increased physiological effect, but also for the purpose of making their administration pleasant to the taste, has much more to do with professional success than is generally supposed. This is particularly so in regard to children, for parents dislike forcing their children to take doses which they themselves regard as unpleasant, and they are every ready to believe that as long as a medicine tastes good it is better than one which tastes otherwise.

The medical practitioner who prescribes never so wisely and appropriately for a patient, but who is utterly regardless as to his combinations of drugs so far as taste is concerned, will sooner or later see a more ignorant man take from him that practice which his greater widsom entitles him to, but which is driven from him by his own errors in this matter.

While in some cases there is no alternative but to give an unpleasant dose, in others a little thought and care will often avoid offending the taste of the patient.

STRENGTH AND RELIABILITY OF DRUGS.

The strength and reliability of drugs is an important matter to be borne in mind by the physician for impurity or lack of potency may be vital factors in a seriously ill patient. For many years variations were unavoidable to a great degree, either because our knowledge of the active principles of drugs and the methods of isolating them was deficient, or because the time consumed in their transportation by sailing vessels or on the backs of natives from the countries in which the natural products yielding the drugs were obtained, permitted deterioration to take place. At present these difficulties have been largely overcome. The trained pharmacist is taught how to make an assay for active principles in most of the valuable alkaloidal drugs, and every physician should make careful investigation into the quality of all preparations which he employs. As an illustration of this matter the following facts are of interest. An intimate friend of the writer bought from five of the leading druggists of Philadelphia 6 ounces of tincture of nux vomica which were stated to have been made according to the directions of the United States Pharmacopœia. That made by perhaps the leading druggist of the five contained twice as much strychnine and brucine as it should, and had twice as much solid residue; or, in other words, a physician prescribing this tincture in full dose would probably have poisoned his patient and reported the case as one of unusual susceptibility to drugs; On the other hand, the author has seen a tincture of nux vomica which contained only a trace of alkaloid, but had much inert solid residue. In neither instance was the druggist dishonest intentionally, but one had used a crude drug which was unusually rich in alkaloids, while the other had purchased nux vomica beans which, by reason of immaturity, bad surroundings, or exposure to weather, were very poor in active principles. Such an uncertainty as to the strength of this particular product is now prevented by the directions of the U. S. Pharmacopœia, but the illustration as to many other drugs still holds good. All these disadvantages may be avoided if physicians will insist that the druggists who dispense the drugs they order shall either themselves prepare assayed products, or purchase such products from any one of the large manufacturing chemists who put assayed physiologically goods on the market. When this is impossible, the physician should employ the alkaloids in pill form, or, if solutions are desirable, the alkaloid may be added to alcohol or water and given by drops, as is the case with any ordinary tincture. Digitalis, veratrum viride, and ergot are practically the only drugs of importance of which an assay cannot be made; in the first and third the action of the drug does not depend upon a single active principle, but upon a number difficult of assay, and in the second the relative proportions of jervine and protoveratrine cannot well be estimated. All drugs should be physiologically tested when their chemical assay is impossible. Not long since several thousand pounds of ergot were found to be worthless on being tested physiologically by one firm; but it was put upon the market nevertheless, for certain manufacturers do not employ this method of examination. Constant uncertainty as to the strength of a drug is a dangerous element when dealing with patients who are desperately ill; and in many cases failure and discouragement will both be avoided if the physician will see to it that the drugs which he administers are capable of doing what he requires of them. A poor drug to the physician is worse than a poor knife to the surgeon; for the failure in the one case is unknown, while in the other it can be carefully watched and guarded.

IDIOSYNCRASY.

This is one of the most interesting features of the study of the action of drugs. It is a frequent cause of disappointment to both patient and physician, and an equally frequent cause of excessive action from what the medical attendant has thought to be a moderate dose. No rule can be laid down for the discovery of idiosyncrasy in a given case, except that females, particularly of the hysterical type, are more subject to it than are males, although certain men often present marked evidences of this tendency. No better illustration of idiosyncrasy can be adduced than the case which here follows, nor than that of a friend of the author who cannot eat a strawberry without suffering from a violent attack of hives.

The first case is that of a woman of thirty years, suffering from a severe headache, who received an eighth of a grain of the hydrochloride of pilocarpine, hypodermically, every twenty minutes, until nearly three-fourths of a grain was taken, without any evidence of its action either in salivary flow or sweat. But the tolerance of drugs did not stop here. Twenty drops of tincture of cannabis every four hours failing to relieve the pain, half-grain pills of the solid extract were ordered, two of which commonly affect a grown man most markedly. The extract had been proved to be active in other patients. In order to avoid any failure in absorption the pills were each cut in half before they were given, and forthwith administered, one every three hours, without any effect after ten had been taken. Twenty more of the pills from the same manufacturers, but from a different retailer, were now given, one every hour with the exception of a few irregularities in administration during the night, the entire twenty being swallowed between four o'clock one afternoon and two o'clock the next afternoon. The thirty pills (fifteen grains) were taken in less than forty-eight hours without producing a single physiological sign of the slightest character. That the doses were really swallowed would seem to be undoubted, for their administration was carried out by a trained attendant, and their black color forbade their expulsion from the mouth on the bed without attracting attention. The hypodermic injections were given by the author, and, as the solution was used as fast as it was made, the patient must certainly have received all of the pilocarpine. As there was daily an afternoon rise of temperature amounting to several degrees, quinine bisulphate was ordered in the dose of fifteen grains, to be given after six powders of one-sixth of a grain of calomel had been taken; this not only failed to control the fever, but also produced no buzzing in the ears. The writer was now inclined to consider all the symptoms as hysterical, even including the evening rise of temperature. Twenty-four hours after the last dose of cannabis the attendant gave the patient, without orders, no less than sixty grains of antipyrine in sixteen hours without any physiological symptoms, and, under orders, she took from forty to fifty grains of bisulphate of quinine every day for three days without any signs of cinchonism.

Wide experience has taught us, however, that several conditions act fairly constantly in regard to some idiosyncrasies. Certain diseased conditions—such as peritonitis or pain—allow large doses of opium to be given, and in lead poisoning and paralysis patients may take enormous doses of active purgatives without moving the bowels.

The *climate* in which the patient lives, or has been accustomed to live, renders him more or less susceptible to certain remedies. Thus the East Indian runs amuck after eating hasheesh or cannabis, or the Chinaman goes into a delightful dreamland from smoking opium, whereas the Anglo-Saxon experiences no such agreeable sensation, as a general rule. Southerners generally require larger doses of purgatives than Northerners, often because the liver is not so active.

The *temperament* of an individual is also a highly important matter to be considered. It is a notorious fact that phlegmatic dark-skinned individuals usually yield to drugs less readily than blondes and nervous persons, more especially in respect to the drugs which act on the nervous system. Nervous light-haired women stand belladonna very badly as a general rule, while children will take large doses often without discomfort. Opium is usually badly borne by children.

Habit is another important factor governing idiosyncrasy. We all know how rapidly one becomes accustomed to tobacco and how morphine *habitués* take enormous amounts of their favorite drug without effect.

INDICATIONS, CONTRAINDICATIONS AND DEFINITIONS.

The indication for a drug is any symptom or condition, or series of symptoms or conditions, which we know the drug will relieve without causing at the same time an evil effect to be felt by other parts of the body. A contraindication is any coëxisting state or tendency which will be made so much worse by the drug as to forbid its use. Thus, one might be tempted to give quinine in meningitis for the fever, yet this would be bad therapeutics, since quinine is contraindicated because it will increase the meningeal congestion. As practically all remedies exercise more than one effect in the body, the secondary effect may be so powerful that the usefulness of a drug is greatly impaired or its use contraindicated.

Abortifacients form a class of drugs, which, as such, ought never to be employed. If pregnancy is to be interfered with, the interruption should be produced by instrumental means, and then only after consultation with another practitioner to get his views and protect one's self from possible legal difficulties.

Alteratives are generally indicated where abnormal cell-growth is active to excess, but contraindicated where tissue break-down is present, or when there exists a tendency thereto.

Anesthetics are used to abolish sensation. They are either local or general. Many of the local anesthetics produce loss of sensation through benumbing the parts by the cold they produce. Cocaine is an example of a local anesthetic which causes anesthesia by a direct paralyzant action on the peripheral sensory nerves. The general anesthetics are taken by inhalation and act upon the higher centers in the brain. As the whole volume of the blood passes through the lungs every half minute, volatile drugs are rapidly absorbed.

Anaphrodisiacs are used to diminish sexual desire.

Aphrodisiacs are used to increase sexual desire and power.

Antacids are employed in cases in which, as a result of morbid processes, lactic and butyric acids, or even hydrochloric acid, are found in abnormal quantities in the stomach.

Anthelmintics are used for the purpose of removing intestinal worms.

Antiarthritics is the name given those drugs which are employed for the purpose of relieving inflammations occurring in joints, whether these be in an acute or chronic condition of disease.

Antihydrotics are used to prevent excessive sweating, either local or general. Camphoric acid is probably the best general antihydrotic.

Antiperiodic is an old fashioned term applied to drugs or remedies employed for the prevention or cure of malarial infection. They are so named because they tend to diminish or arrest the periodicity of the attacks, which periodicity is a characteristic of such diseases.

Antiphlogistics are employed to prevent the progress of inflammatory processes. They are nearly all contraindicated in the presence of tissues possessing impaired vitality through previous conditions of disease.

Astringents are employed for the purpose of contracting or constringing tissues. They act either by coagulation of albumin, by precipitating albumin, or by making the tissues more dense by concentration. Theoretically, all astringents should be non-irritating, but practically they possess irritant properties, and are, in consequence, contraindicated in the presence of very acute inflammations as a rule. Three of the mineral astringents, however, possess marked sedative properties in addition to their astringent power, and can therefore be used freely in acute inflammation when locally applied. They are nitrate of silver, subacetate or acetate of lead, and the subcarbonate or subnitrate of bismuth.

Bitters are designed to increase the activity of the mucous membrane of the gastro-intestinal canal by increasing its tone. They may be divided into simple bitters and complex bitters. The first depend upon their bitterness solely for their activity; the second class is well represented by quinine and strychnine, both of which are exceedingly bitter, but, in addition to their local effect on the gastro-intestinal mucous membrane, act as stimulants to other portions of the organism. A good example of a simple bitter is columbo. Many bitters contains so much tannic acid that they are not generally useful, and for this reason very few can be used with preparations of iron, since a tannate of iron would be formed.

Cardiac sedatives decrease the force of the heart, and, as a class, the amount of blood expelled at each beat of the ventricles. They are indicated in arterial excitement and contraindicated in arterial depression.

Cardiac stimulants increase the force of the heart, thereby increasing the quantity of blood expelled from the ventricles. Their effect may be accomplished by an increase in the rapidity of the beats or by a greater output of blood at each contraction, the diastole being sufficiently prolonged to admit of the ventricles being well filled. They are contraindicated in the presence of arterial excitement, and indicated in arterial depression.

Carminatives are given for the purpose of expelling flatus, particularly if there is reason to believe that the "wind" has accumulated because of intestinal torpidity. Many of the carminatives are necessarily possessed of irritant properties, and are therefore contraindicated in the presence of flatulence due to intestinal atony arising from inflammation. The best carminative is spiritus etheris.

Cathartics.—These are drugs employed when a positive and decided action of the bowels is desired. They occupy a position between the purges and the drastics. (See Purges and Drastics.)

Cholagogues are used to exert a stimulant influence upon the flow of bile. Nitrohydrochloric acid and mercury bichloride are perhaps the best types of pure cholagogues, while podophyllum, blue mass, and calomel represent the class of cholagogues which increase intestinal peristalsis in addition to stimulating the flow of bile. Cholagogues are, as a rule, contraindicated in the presence of acute inflammation of the gall-bladder or liver.

Counterirritants are used to produce irritation at a spot distant from a painful or inflamed area, in order to relieve the diseased parts by reflex action exerted through the nervous system upon the painful nerve or disordered capillary network.

Demulcents are used to protect from irritation any exposed parts of the body.

Diaphoretics produce an increased secretion from the sweat-glands. They may be considered as internal and external. The internal are represented by pilocarpine, which stimulates the sweat-glands themselves; the external are represented by the Turkish and Russian baths which, by increasing bodily heat and dilating bloodvessels, cause a profuse sweat.

Diuretics are used to increase the flow of urine from the kidneys. They act by stimulating the renal epithelium to greater activity, thereby increasing the excretion of both the watery and solid constituents of the urine; or they simply increase the watery constituents by increased blood-pressure in the kidney, or again they may increase urinary flow by preventing the normal reabsorption of fluid by the tubules.

It is to be remembered that the vegetable salts of potassium and the sodium salts are in reality indirect diuretics, not by stimulating the secreting epithelium of the kidney, but because when salts of these bases are taken into the body it is the function of the kidneys to get rid of them so that the saline tonicity of the blood and tissues will be maintained. (See Eliminators.) They are indicated in conditions of renal inactivity due to functional causes. If the kidneys are so diseased as to be incapable of eliminating these salts they do harm. Irritating diuretics, such as cantharides, for example, are contraindicated in acute nephritis. Such a diuretic is only to be used where the kidneys are inactive through atony.

Eliminators are drugs which, by forming soluble compounds with insoluble substances in the body, render them capable of being excreted by the excretory organs, such as the skin, kidneys and bowels.

Emetics are used to produce vomiting. They act centrally when, as is the case with apomorphine, they stimulate the vomiting center; peripherally when they irritate the walls of the stomach. They are indicated when we wish to unload the stomach of undesirable materials, or when we desire to cause an increased flow of bile from the gall-bladder, which is accomplished by the pressure exerted upon this viscus when the abdominal walls and diaphragm contract in retching.

When the ducts are mechanically obstructed by a gall stone emetics are dangerous, as they may cause rupture of the gall-bladder.

Sometimes we are able by the use of emetics to rid the lungs and stomach of the mucus in bronchitis or gastric catarrh.

The contraindications to emetics are cerebral congestion or meningitis, gastritis, gastric ulcer, advanced pregnancy and hernia.

Emmenagogues are used to produce or increase the menstrual flow.

They are of two classes—direct and indirect. The direct are many of them irritants, and are seldom of much value with the exception of corpus luteum; the indirect are used to overcome the morbid condition underlying the menstrual disorder, and are therefore more rational. Thus iron and arsenic may be used with beneficial result in amenorrhea due to anemia.

Expectorants are employed when it is desirable to promote secretion or to get rid of secretion in the bronchial tubes. Thus, in the early stages of an acute bronchitis the mucous membrane is hyperemic and swollen, but dry and irritable. Ipecac and citrate of potassium form at this time a sedative expectorant mixture, which, while allaying irritation, promotes secretion and so relieves the engorged area. On the other hand, after the acute stage is passed, there may be so much atony of the mucous glands that the secretion is either too scanty or too viscid to be coughed up. Stimulant expectorants, such as chloride of ammonium, eucalyptus and terebene are now to be employed. These latter drugs are contraindicated in the acute inflammatory stage of the disease, as they would simply stimulate the mucous membrane to greater irritation.

Hypnotics are used to produce sleep. They may be divided into those which produce sleep and relieve pain, and those which have no analgesic power. The latter are therefore not to be employed in sleeplessness due to pain, and the former are contraindicated when pain is absent. Thus, barbital sodium produces sleep, if it be ordinary functional insomnia; but if the sleeplessness is due to pain, opium is the drug to be employed. Chloral, in ordinary doses, is the purest hypnotic that we have.

Mydriatics produce dilatation of the pupil, or mydriasis. Conditions of the eye associated with increased intraocular tension are contraindications to mydriatics, as a rule.

Myotics cause contraction of the pupil or myosis. They are best represented by eserine.

Nervous sedatives are indicated and contraindicated in a reverse manner to nervous stimulants.

Nervous stimulants are contraindicated in nervous excitement, and indicated in nervous depression.

Oxytocics increase the expulsive power of the uterine muscle.

Revulsives are used to produce increased activity of the general system or parts thereof through reflex influences—that is, they cause a determination of blood to one part, thereby relieving an engorged area. Thus, in cerebral congestion or effusion a vigorous purgative or cathartic may give relief by exercising a derivative effect. Revulsives are closely allied to counterirritants. They are rarely resorted to.

Roborants are devoted to the repair and building up of tissues in the body, and comprise both food and drugs. Roborant treatment also includes hygienic surroundings, fresh air, light and healthful employment.

Tonics are used to increase vital activity. They are indicated in local or general systemic depression and contraindicated in cases of inflammation or excitation with excessive functional activity. (See Bitters.)

Vasomotor depressants decrease arterial pressure by an action on the vasomotor nervous system rather than by an action on the heart. They act by relaxing the bloodvessels.

Vasomotor stimulants increase arterial pressure by an action on the vasomotor system, thereby producing contraction of the bloodvessels.

CLASSIFICATION OF DRUGS.

In order that the student may gain a definite idea as to the various actions of different remedies the following list of drugs is appended, which is of necessity somewhat arbitrary and is not intended to be exhaustive, for many remedies might be placed in several classes. The endeavor has been made to place the best or most powerful drug of each class first in the list. It is to be remembered that a strict physiological classification is impossible.

I. ALTERATIVES.

1. Mercury.
2. The iodides of potassium and sodium.
3. Iodine.
4. Iodoform.
5. Iodol.
6. Arsenic.
7. Cod-liver oil.
8. Colchicum.
9. Ichthyol.
10. Taraxacum.
11. Mezereum.

II. ANÆSTHETICS.

1. Ether.
2. Nitrous oxide gas.
3. Chloroform.
4. Cocaine.
5. Eucaine.
6. Bromide of ethyl.
7. Chloride of ethyl and of methyl.
8. Pental.
9. Bromoform.
10. Phenol.
11. Antipyrine.
12. Ethylene.

III. ANTACIDS.

1. Ammonia.
2. Sodium and its salts.
3. Liquor potassii hydroxidi.
4. Magnesia.
5. Lime.

IV. ANTHELMINTICS.

Those that are used against the round-worm are—

1. Santonica.
2. Spigelia.
3. Chenopodium.
4. Azedarach.

Those used against the tape-worm are—

1. Pelletierine.
2. Aspidium.
3. Pepo.
4. Pomegranate.
5. Brayera.
6. Kamala.
7. Turpentine.
8. Chloroform.

Those used against the seat worm, or Oxyuris vermicularis, are—

1. Quassia.
2. Turpentine.
3. Tannic acid.
4. Sodium chloride.
5. Vinegar.

V. ANTISEPTICS. (See also Disinfectants.)

1. Corrosive sublimate in weak solutions.
2. Phenol (carbolic acid.)
3. Peroxide of hydrogen.
4. Creolin.
5. Chlorine compounds.
6. Boric acid.
7. Permanganate of potassium.
8. Salicylic acid.
9. Salts of silver.

VI. ANTIPERIODICS or ANTIMALARIALS.

1. Cinchona.
2. Eucalyptus.
3. Warburg's tincture,
4. Arsenic.
5. Methylthionine hydrochloride (methylene blue.)

VII. ANTIPYRETICS.

1. Antipyrine.
2. Acetanilide
3. Acetphenetidin (phenacetin.)
4. Guaiacol.
5. Phenocoll.
6. Quinine.
7. Salicylic acid.
8. Phenol (carbolic acid).

VIII. ANTISPASMODICS.

1. Amyl nitrite.
2. Hydrated chloral.
3. Bromides.
4. Opium.
5. Belladonna.
6. Camphor.
7. Hoffmann's anodyne.
8. Asafœtida.
9. Musk.
10. Valerian.
11. Monobromated camphor.
12. Amber.
13. Cimicifuga.
14. Hops.

IX. ASTRINGENTS.

Vegetable:

1. Tannic acid.
2. Hæmatoxylon.
3. Kino.
4. Gambir.
5. Rhatany or krameria.
6. Rhus glabra.
7. Geranium.
8. White oak.
9. Black oak.
10. Gallic acid.
11. Rosa centifolia.
12. Rosa gallica.

All of these depend chiefly upon tannic acid for their active principle.

Mineral:

1. Sulphuric acid.
2. Alum.
3. Lead.
4. Nitrate of silver.
5. Nitric acid.
6. Sulphate of copper.
7. Bismuth.
8. Sulphate of zinc.

X. CARDIAC SEDATIVES.

1. Aconite.
2. Veratrum.
3. Antimony.
4. Hydrocyanic acid.
5. Veratrine.

XI. CARDIAC STIMULANTS.

1. Digitalis.
2. Strophanthus.
3. Ammonia.
4. Ether.
5. Alcohol.
6. Caffeine.
7. Nux vomica.
8. Ignatia.
9. Adonis vernalis.
10. Convallaria majalis.
11. Sparteine.
12. Amyl nitrite (momentarily).
13. Opium.

XII. COUNTER-IRRITANTS.

Those counter-irritants that blister are called epispastics. They are—

1. Cantharides.
2. Thapsia.
3. Ammonia or chloroform when under a watch-glass.

Those that redden or produce local hyperæmia of the skin are—

1. Mustard.
2. Capsicum.
3. Turpentine.
4. Ammonia.
5. Chloroform.
6. Burgundy pitch.
7. Canada pitch.
8. Most of the spices.

Under the name of ESCHAROTICS are grouped a number of substances capable of acting as destructive agents upon the soft tissues of the body. They are—

1. Chromium trioxide (chromic acid).
2. Nitric acid.
3. Sulphuric acid.
4. Nitrate of mercury (solution).
5. Bromine.
6. Potassium hydroxide.
7. Sodium hydroxide.
8. Burnt alum.
9. Arsenic trioxide.
10. Chloride of zinc.
11. Vienna paste.
12. Canquoin's paste.

XIII. DIAPHORETICS.

The only ones that we know as direct stimulants to the glands are—

1. Pilocarpus or jaborandi.
2. Warburg's tincture.

The others are—

3. Hot dry and hot moist baths.
4. Dover's powder.
5. Alcohol (particularly when hot).
6. Nitrous ether.

XIV. DIGESTANTS.

1. Pancreatin.
2. Pepsin.
3. Hydrochloric acid.
4. Diastase.
5. Papain.

XV. DISINFECTANTS.

1. Corrosive sublimate.
2. Chlorine or chlorinated lime.
3. Formaldehyde.
4. Phenol.
5. Chloride of zinc.

XVI. DIURETICS.

Those that increase both the solids and liquid constituents are probably—

1. Caffeine.
2. Squill.
3. Cantharides.
4. Buchu.
5. Vegetable salts of potassium.
6. Lithium.
7. Juniper.
8. Turpentine.
9. Uva ursi.
10. Chimaphila.
11. Cubebs.
12. Pareira brava.

Those which increase the watery portion of the urine without increasing the solids proportionately are—

1. Digitalis.
2. Strophanthus.
3. Apocynum.
4. The Nitrites.

XVII. ELIMINATIVES.

1. The iodides.
2. The salicylates.
3. The vegetable salts of potassium and the purgatives.
4. The lithium salts.
5. Jaborandi.
6. Colchicum (probably).

XVIII. EMMENAGOGUES.

The direct emmenagogues are—

1. Apiol.
2. Dioxide of manganese.
3. Permanganate of potassium.
4. Cantharides.
5. Aloes.
6. Myrrh.
7. Rue.
8. Savine.
9. Tansy.
10. Pennyroyal.
11. Guaiac.

The indirect are—

1. Iron.
2. Arsenic.
3. Copper.
4. Tonics in general.

XIX. EMETICS.

The direct are represented by—

1. Apomorphine.
2. Ipecac (which is both centric and peripheral).
3. Tartar emetic (which is both centric and peripheral).

The peripheral are—

1. Sulphate of zinc.
2. Mustard.
3. Alum.
4. Sulphate of copper.
5. Turpeth mineral.

XX. EXPECTORANTS.

Sedatives:

1. Citrate or acetate of potassium.
2. Ipecac.
3. Antimony.
4. Lobelia.

Those which act as stimulating expectorants are—

1. Ammonium chloride.
2. Apomorphine.
3. Creosote.
4. Eucalyptus.
5. Tar.
6. Terebene.
7. Terpine hydrate.
8. Oil of sandal-wood.
9. Sulphur.
10. Grindelia robusta.
11. Garlic.
12. Squill.

Besides these we have nux vomica, which increases expectoration by stimulating the nervous system to coughing, and thus expels the mucus. Opium and the bromides depress the nervous system and allay cough, and so decrease expectoration.

XXI. HYPNOTICS.

1. Barbital sodium.
2. Barbital (veronal).
3. Sulphonethylmethane (trional).
4. Sulphonmethane (sulphonal).
5. Chloral hydrate.
6. Bromides of potassium, sodium, etc.
7. Opium.
8. Tetronal.
9. Paraldehyde.
10. Chloralose.
11. Chloralformamide (chloralamide).
12. Hypnal.
13. Hyoscine (in mania).
14. Duboisine (in mania).
15. Cannabis (in large dose).

XXII. NERVOUS SEDATIVES.

1. Hydrated chloral.
2. Opium (in full doses).
3. The bromides and hydrobromic acid.
4. Chloroform.
5. Amyl nitrite.
6. Nitrites of potassium and sodium and nitroglycerin.
7. Ether.
8. Bromide of ethyl.
9. Nitrous oxide.
10. Bromoform.
11. Belladonna.
12. Antipyrine.
13. Acetanilide.
14. Acetphenetidin (phenacetin).
15. Calabar bean.
16. Hydrocyanic acid.
17. Lobelia.
18. Conium.
19. Cannabis.
20. Sulphonmethane (sulphonal).
21. Croton chloral.
22. Paraldehyde.
23. Camphor.
24. Monobromated camphor.
25. Asafœtida.
26. Amber.
27. Hoffmann's anodyne.
28. Cimicifuga.

29. Musk.
30. Valerian.
31. Humulus.
32. Castor.
33. Phenobarbital.

XXIII. Nervous Stimulants.

1. Nux vomica.
2. Ignatia.
3. Coca.
4. Kola.
5. Caffeine.

XXIV. Oxytocics.

1. Pituitrin.
2. Ergot.
3. Cotton-root.
4. Ustilago maydis.

And indirect when in labor.

1. Quinine.
2. Kola.

XXV. Purgatives.

Laxatives:

1. Rhamnus purshiana (cascara sagrada).
2. Aloes.
3. Phenolphthalin.
4. Sulphur.
5. Rhubarb.
6. Frangula.
7. Cassia fistula.
8. Euonymus.
9. Magnesium oxide (magnesia).
10. Manna.
11. Fruits.

Cathartics (mineral):

1. Magnesium sulphate.
2. Magnesium citrate.
3. Sodium phosphate.
4. Potassium and sodium tartrate.
5. Sodium sulphate.
6. Mercury.

Cathartics (vegetable):

1. Castor oil.
2. Senna.
3. Podophyllin.

Cathartics (hydragogue):

1. Elaterium.
2. Jalap.
3. Colocynth.
4. Croton oil.
5. Gamboge.
6. Scammony.
7. The saline purgatives, if concentrated solutions are used.

XXVI. Tonics.

1. Cinchona.
2. Nux vomica.
3. Calumba.
4. Arsenic.
5. Phosphorus.
6. Mercury (in minute doses).
7. Copper.
8. Iron.
9. Hydrochloric acid.
10. Nitro-hydrochloric acid.
11. Nitric acid.
12. Phosphoric acid.
13. Condurango.
14. The vegetable bitters in general.

XXVII. Vasomotor Depressants.

1. Amyl nitrite.
2. Nitroglycerin and other nitrites.
3. Veratrum.
4. Antimony.
5. Aconite.
6. Alcohol (in excessive doses).
7. Jaborandi.

XXVIII. Vasomotor Stimulants.

1. Belladonna.
2. Pituitrin.
3. Suprarenal gland.
4. Digitalis.
5. Nux vomica.
6. Ergot.
7. Caffeine.
8. Convallaria.

INCOMPATIBILITY.

One of the uses of a knowledge of chemistry and pharmacy to a practitioner of medicine is the avoidance of what is known as an "incompatibility," or the placing in a prescription of two or more substances which will undergo chemical interchanges, decompositions, precipitations, or cause the formation of explosive mixtures. It is impossible in this book to detail all the incompatibilities, and only the most dangerous and common possibilities of error can be considered:

1st. An acid should never be combined with an alkali.

2d. A strong acid should not be added in any quantity to a tincture. The following prescription is an illustration of this:

℞—Potassii iodidi		ʒij.
Acidi nitro-hydrochlorici		fʒj.
Tincturæ cinchonæ compositæ	q. s.	f℥iij.—M.

S.—Use as directed: a teaspoonful.

In this ridiculous mixture the acid is incompatible with the iodide of potassium, forming a chloride and setting free iodine, and would also change part of the alcohol in the tincture into an ether.

3d. Alkalies and neutral bases should not be combined with the alkaloidal salts.

℞—Strychninæ sulphatis	gr. j
Potassii iodidi	ʒij
Syrupi sarsaparillæ compositi	f℥iij —M.
S.—Teaspoonful t. i. d.	

In this prescription the strychnine would be precipitated by the potassium salt, and the patient would get nearly all the strychnine in the last dose.

4th. Potassium chlorate should not be ordered to be rubbed up with tannic acid nor any other organic substance capable of oxidation, as it will explode. Permanganate of potassium is subject to the same rule.

5th. Chlorate of potassium and ammonium chloride when mixed together may ignite.

6th. Iron is incompatible with tannic acid, as it forms a tannate of iron, or ink. As most of the vegetable astringents contain tannic acid, they should none of them be used with iron except columbo quassia.

7th. Tannic acid should never be added to solutions of alkaloids.

8th. Gum arabic is not to be added to solutions of iron, lead or the mineral acids.

9th. Alcoholic solutions of camphor and similar resinous substances are incompatible with water.

10th. Most fluidextracts are incompatible with water, as the addition of water will precipitate them.

11th. All salts not acid but alkaline in reaction are decomposed by acids.

12th. All salts which are acid are decomposed by alkalies.

13th. All vegetable acid salts are altered by mineral acids and are decomposed by alkalies.

14th. Iodine and the iodides should not be given with alkaloids.

15th. Corrosive sublimate, the salts of lead, iodide of potassium and nitrate of silver should always be prescribed alone, except in the following instances:

(*a*) Corrosive sublimate may be given with potassium iodide, since it will throw down a precipitate which redissolves and forms a double salt.

(*b*) Nitrate of silver may be used with extract of opium or hyoscyamus.

16th. Syrup of squills should not be given with the carbonate of ammonium, as it contains acetic acid. Chloride of ammonium is not incompatible with it.

17th. Cherry-laurel water should not be prescribed with morphine, as it may form the poisonous cyanide of morphine.

18th. Chloral and cyanide of potassium should never be placed in the same prescription, as they will decompose each other, setting free hydrocyanic acid.

19th. Cocaine and borax when added together form an insoluble borate of cocaine. Boric acid and cocaine do not result in this formation.

20th. Calomel and antipyrine are incompatible, as are also sweet spirit of nitre and antipyrine.

21st. Waters cannot be used in preparing saturated solutions of drugs, as they are already loaded with the volatile substance.

22d. Pepsin and pancreatin should not be used together, since the former can only act in an acid and the latter in an alkaline medium, and the pancreatin is destroyed by the acid gastric digestive process. Further, one ferment may neutralize the other.

THE IMPORTANCE OF DIETETIC TREATMENT.

Many physicians fail to pay proper attention to the regulation of the diet when treating those who are ill or "out of sorts." As a matter of fact, the administration of medicine often fails to produce good results simply because the patient, by persisting in the use of improper food and drink, is perpetuating the difficulty of which he is trying to get rid of. There is scarcely a case in which some regulation or alteration of the diet will not be of advantage to the sick man. (See Foods for the Sick.) Further than this, failure to give directions as to diet is apt to give the patient the idea that the physician is careless, whereas care in this respect will greatly enhance his estimate of the physician's ability to attend to important details of the case.

PRESCRIPTION WRITING.

When a physician directs a patient how to regulate his diet, what exercise he is to take, and how many hours a day are to be devoted to recreation and work, he prescribes for him quite as much as when he writes a prescription calling for one or more drugs which are to be dispensed by the druggist and swallowed by the individual who is ailing. Nevertheless, the word "prescription" is usually applied to the piece of paper on which is written the physician's order to the druggist.

In writing prescriptions physicians usually employ Latin terms. There are several reasons for this. In the first place, it is a custom which has been followed since the time when medical science was in its infancy, and medical men were wont to write what they had to say in Latin. Secondly, the botanical names of plants are usually in Latin: first, because scientific men give them their names, and second, because not infrequently the English name for a plant in one part of a country has an entirely different application in another. Thus nearly every State has a drug called "snake-root," yet in each instance a different plant may be so designated. Again, it is often advisable that a patient be kept in ignorance of the character of the drug which he is taking, lest he attempt to use it without a physician's advice on another occasion, and thereby do himself injury. Thus the physician might wish to give a patient a dose of coca as a powerful nervous stimulant, yet would fear that it might be taken without advice later, and do harm. By using the word "Erythroxylon" the druggist knows what to dispense, but the patient does not recognize the term used and fails to remember it.

All prescriptions should be written on a blank on which are printed the physician's name, address and office hours. This information is necessary, particularly as it is useful to the druggist, who may wish to communicate with the physician in case he thinks that a poisonous dose has been ordered by mistake. The name and address of the patient should be written on the prescription blank, so that the druggist may know where the medicine is to be sent. The prescription is to be accurately dated, and it is better to keep carbon copies. If a narcotic drug is to be dispensed the registration number of the physician should be on the blank, and his full name must be signed.

The symbol or mark placed on a prescription-blank after writing the name of the patient and his address is "℞," which stands for "Recipe," which is the second person singular of the imperative present of the Latin verb "Recipio," meaning "I take." Recipe or ℞, therefore, says to the druggist "Take thou" of whatever substances the physician desires. As he is to take a given quantity of his stock and place it in the mixture, the name of the drug is put in the partitive genitive case. When, however, a pill or other finished or complete product is ordered, so that not part of the stock, but the whole article is desired, the name of the medicine is placed in the accusative case, since it is the object of the verb.

The nouns or names of drugs belong to one of the five Latin declensions, and are most of them declinable. Those of the first declension end in the letter "a" in the nominative singular, and in "æ" in the genitive singular, or "arum" in the genitive plural, except in the case of the word aloe, the genitive singular of which is aloes. Thus *aqua* is the nominative, *aquæ* is the genitive singular, and *aquarum* is the genitive plural.

The nouns of the second declension end either in "us" if masculine, or "um" if neuter. Their genitive singular ends in "i" and the genitive plural in "orum." There are several nouns of this declension which end in "on," like "hematoxylon," which also end in "i" in the genitive singular. Thus we find that *Syrupus* is the nominative, *Syrupi* the genitive singular, and *Syruporum* the genitive plural.

In the third declension the nouns end in a, e, i, o, y, c, l, m, r, s, t, and x. The genitive singular ends in "is" and the genitive plural in "um." Thus, *Æther* in the genitive is *Ætheris*, and the genitive plural *Ætherum*. When the noun ends in "s" the genitive takes a "t" before the "is." Thus *boras* is the nominative singular, *boratis* the genitive singular, and *boratum* the genitive plural.

In the fourth declension the masculine nouns end in "us," and the neuter nouns in "u." The genitive singular of the masculine noun ends, as does the nominative, in "us," and the neuter noun like the nominative ends in "u," while the genitive plural ends in "um." Thus, *Spiritus*, of which the nominative singular ends in "us," is *spiritus*, in the genitive singular and *spirituum* in the genitive plural.

In the fifth declension the nominative singular ends in "es," the genitive singular in "i," and the genitive plural in "rum." Thus, *Res* has as its genitive singular *rei*, and as its genitive plural *rerum*.

Adjectives used to qualify nouns agree with them in gender, number and case.

After the ingredients and their quantities have been signified the physician expresses his wishes further, and writes the word "Misce," "mix," the ingredients. If the prescription is put up in fluid form, he next writes the *signatura*, and writes the word *Signa*, usually abbreviated by *Sig.*, which tells the druggist to write the directions, which follow in English, on the label of the bottle.

If the prescription consists in a powder and is to be put up in papers, after the word *Misce*, or the letter "M.," which stands for *Misce*, the physician adds *et divide in chartulas No. xx.*—that is, divide into twenty small papers or powders. If pills are desired, he writes *M. fiant* (often written "ft.") *pilulæ No. xx.*—that is, make into 20 pills.

Or *fiat unguentum*, let an ointment be made.

Or the imperative may be used by the employment of the word *fac*, as *fac suppositorias numero v.*— that is, "Make thou 5 suppositories."

If capsules are desired, the druggist is directed to mix the ingredients, and the physician adds *et pone in capsulas No. xx.*—that is, mix and put into 20 capsules.

A prescription is often composed of a *basis* or the drug that is most important, an *adjuvant* or the drug to aid the basis, a *corrective* to overcome some effect which is undesirable, and a *vehicle* to give bulk and to carry the active substances into the body. After the name of the vehicle, which is also designed to bring up the mixture to an even quantity, we add the words *quantum sufficit ad* (a sufficient quantity to), usually abbreviated to "q. s. ad," to make the number of ounces desired.

A complete prescription may therefore be written as follows:

For Mr. John Jones, 111 Bank Street.
October 31, 1907.

℞—Bismuthi subnitratis	gr. xl
Creosoti	♏x

Misce et pone in capsulas No. xx.
S.—Take one after each meal.

Or

℞—Acidi sulphurici aromatici		f ʒij
Fluidextracti hæmatoxyli		f ʒiv
Spiritus chloroformi		f ℥j
Syrupi zingiberis	q.s. ad	f ℥iij

Misce.
S.—Take 1 dessertspoonful in water every three hours.

In the last prescription the sulphuric acid is the *basis*, the hematoxylon and spirit of chloroform are the *adjuvants*, and the syrup of ginger is the *vehicle.*

Latin Word.	Abbreviation.	Translation.
Ad.		To, up to.
Ad lib'itum.	Ad lib.	At pleasure.
Adde.	Add.	Add (thou).
Ana.	A., āā.	Of each.
Aqua bul'liens.	Aq. bull.	Water, boiling.
Aqua destilla'ta.	Aq. dest.	Water, distilled.
Aqua fonta'na, fervens.	Aq. font., ferv.	Water, spring, hot.
Aqua pluvia'lis.	Aq. pluv.	Water, rain.
Aqua'lis.		Pertaining to water.
Bene.		Well.
Bis in dies.	Bis in d.	Twice daily.
Bulliat, bulliant.	Bull.	Let boil.
Cape, capiat.	Cap.	Take. Let him take.
Cap'sula.	Caps.	A capsule.
Cera'tum.	Cerat.	A cerate.
Char'ta (karta).	Chart.	A paper (medicated).
Chartula (kartula).	Chart.	A little paper for a powder.
Cibus.	Cib.	Food.
Cochle'are magnum.	Coch. mag.	A tablespoon.
Cochle'are parvum.	Coch. parv.	A teaspoon.
Cola, colatus.	Col.	Strain. Strained.
Colluto'rium.	Collut.	A mouth-wash.
Collyr'ium.	Collyr.	An eye-wash.
Compos'itus.	Co., Comp.	Compound.
Confec'tio.	Conf.	A confection.
Con'gius.	C.	A gallon.
	C.c.	A cubic centimeter or cubic centimers.
Cum.		With.
Dilute, Dilu'tus.	Dil.	Dilute (thou), diluted.
Dimid'ius.	Dim.	One-half.
Divida'tur in partes æquales.	D. in p. æq.	Let it be divided into equal parts.
Div'ide.	D., Div.	Divide (thou).
Dividen'dus.	Dividend.	To be divided.
Do'sis.	Dos.	A dose.
Extend'de supra.	Exten. sup.	Spread upon.
Fac, fiat, fiant.	F.	Make, let be made, let them be made.
Fil'trum, Filtra.	Fil.	A filter. Filter (thou).
Gargaris'ma.	Garg.	A gargle.
Grammum, Gramma.	Gm.	A gram, grams.
Gutta, Guttæ.	Gtt.	A drop, drops.
Gutta'tim.	Guttat.	Drop by drop.
Haus'tus.	Haust.	A draught.
Hora.	H., Hor.	An hour.
In dies.	Ind.	Daily.
Lage'na (lajena).		A flask or bottle.
Libra.	℔.	A pound, a Troy pound.
Lo'tio (losheo).		A lotion.
Mag'nus.	Mag.	Large.
Mane primo.	Mane pr.	Very early in the morning.
Mas'sa.	Mass.	A pill-mass.
Mica pa'nis (mika).	Mic. pan.	A crumb of bread.
Misce.	M.	Mix.
Mistu'ra.	Mist.	A mixture.

Latin Word.	Abbreviation.	Translation.
Nox, Nocte maneque.		Night, at night and in the morning.
Numerus, Numero.	No.	A number, in number.
Octarius.	O.	A pint.
Pars.	Par.	A part (governs genitive).
Partes æquales.	P. æ.	Equal parts.
Parvus.	Parv.	Small.
Pediluvium.		A foot-bath.
Pencillium camelinum.	Pencil. cam.	A camels'-hair pencil or brush.
Per fistulam vit-ream.		Through a glass tube.
Phiala.	Phil.	A vial.
Pro re nata.	P. r. n.	According to circumstances, occasionally.
Quantum sufficiat.	Q. s. (followed by genitive).	As much as is necessary.
Quaqua hora.	Q. h.	Every hour.
Saturatus.	Sat.	Saturated.
Scatula.	Scat.	A box.
Secuncia.	Secunc.	An ounce and a half.
Semidrachma.	Semidr.	A half-drachm.
Semissis.	Ss.	A half.
Signa.	S., Sig.	Sign.
Sine.		Without.
Solutio.	Sol.	A solution.
Solve, Solutus.	Solv.	Dissolve, dissolved.
Spiritus.	Spr.	A spirit.
Statim.	Stat.	Immediately.
Talis.	Tal.	Such, or like.
Tere simul.	Ter. sim.	Rub together.
Ter in die.	T. i. d.	Three times a day.
Vehiculum.	Vehic.	A menstruum.
Vitello ovi solutus.	V. o. s.	Dissolved in the yolk of an egg.
Vitellus	Vit.	The yolk (of an egg).

PART II.

DRUGS.

ACETANILID.

Acetanilidum, U. S. and B. P., is the monacetyl derivative [$C_6H_5NH(CH_3.CO)$] of aniline.

It occurs as colorless, shining, micaceous, crystalline laminæ, or a crystalline powder; odorless, having a slightly burning taste, and permanent in the air. It is soluble in 190 parts of water and in 3.4 parts of alcohol at 25° C. (77° F.); in 20 parts of boiling water and in 0.6 part of boiling alcohol; also soluble in 17 parts of ether and 3.7 parts of chloroform at 25° C. (77° F.). It is made by the action of glacial acetic acid upon aniline, forming acetanilid or phenyl-acetamide. The word *antifebrin* is a registered name, and its use should be avoided by the profession, since its employment obliges the druggist to use the acetanilid made by one firm instead of the drug made by other chemists who manufacture it as an ordinary chemical compound, and do not charge so high a price as do those who market the product under a registered name.

Physiological Action.—Acetanilid has been studied experimentally and clinically to a very great extent, and fairly definite outlines of its action have been mapped out.

NERVOUS SYSTEM.—On the nervous system acetanilid has been found to act as a sedative, the sensory portion of the nerves and spinal cord particularly being quieted. After a poisonous dose general anesthesia comes on, with total loss of reflex action and with motor and sensory paralysis. The portions of the nervous system affected in these changes are, primarily, the sensory side of the spinal cord and the sensory nerves, the motor apparatus being least influenced. The muscles are only indirectly influenced by the poison.

CIRCULATION.—On the circulation acetanilid has but little direct influence except when used in poisonous doses. Applied to the frog's heart, it at first accelerates its beat and increases its force, but soon causes a weakening, ending with arrest in wide diastole. Upon the higher animals it causes, in toxic dose, an immediate fall of arterial pressure with a diminution in the size of the pulse-waves and all the evidences of cardiac and circulatory depression, notwithstanding the fact that death ensues from respiratory failure. The cause of this fall of blood-pressure is a direct depressing action on the heart associated with failure of the vasomotor system, as asphyxia causes no rise in pressure.

In *medicinal dose* acetanilid causes no circulatory changes of moment in the healthy individual. Sometimes the pulse-rate is increased, sometimes diminished. The tendency is, however, toward depression rather than stimulation of the circulation.

Blood.—When used in large doses, the action of this drug upon the blood is more pronounced than its influence upon any other part of the body, causing this tissue to become brownish-red, decreasing its oxygen-carrying power, and, finally, reducing the hemoglobin to methemoglobin to a very considerable extent. The question as to the influence of acetanilid upon the corpuscles is still undecided some observers declaring that these bodies are disorganized, while others assert that they remain intact. In moderately large poisonous doses it may not affect the corpuscles, but if its use in large amount be continued for some days, or a very large amount be used at one time, corpuscular destruction certainly occurs, free hemoglobin appearing in the urine in its characteristic forms. The normal alkalinity of the blood is decreased, and the urine becomes dark and brownish in color, and the blood crystals of Teichmann are found in it. In medicinal doses the blood shows no change except in cases where idiosyncrasy is present or the doses are unusually large. Under these circumstances the blood in the arterial system becomes darker than normal.

Respiration.—No effect is produced upon this function by acetanilid when given in moderate doses. When poisonous doses are used, the breathing at once becomes rapid and labored. Large doses produce death by paralysis of the respiratory centers. These effects are primarily due to the alterations in the blood, which so influence oxygenation of the tissues as to spur the respiratory centers to greater effort, while at the same time it is beginning to be directly depressed by the drug itself, so that impairment of its function is soon manifest. Bokai asserted that the drug paralyzes the peripheral motor nerves, which, if true, brings forward a third factor in the respiratory failure.

Temperature.—When given in full medicinal doses, acetanilid lowers the normal bodily temperature or else fails to produce any change. In poisonous doses it produces a decrease in temperature depending on the amount employed, and may cause collapse and rigors. On a fever temperature it acts as a powerful and fairly constant antipyretic, lowering the fever by *decreasing heat production* and *increasing heat dissipation*, heat production being the function most affected.[1] Whether the decrease in heat production is due to an action on the heat centers in the nervous system, or upon other causes is not known. Some investigators have claimed that the fall depends upon the partial reduction of the hemoglobin of the blood, whereby less oxygen is carried to the tissues and less combustion ensues. This seems doubtful in view of the fact that spectroscopic examination of the blood fails to show any such change from the use of medicinal doses. That the fall of temperature is not dependent on the sweat produced is proved by the fact that the temperature falls even if enough atropine is given to stop all perspiration.

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[1] The author's reasons for holding to the opinions stated can be found in his Boylston Prize Essay of Harvard University, on Antipyretics.

KIDNEYS, TISSUE-WASTE AND URINE.—Much contradictory evidence exists in regard to the changes which occur in these organs and their excretory products under the influence of acetanilid, but most observers agree that the excretion of urea is increased (Lepine, Chittenden and Taylor). Less uncertainty exists as to its influence on the elimination of uric acid, which is increased rather than diminished by the drug. After excessively large doses the urine becomes dark from the presence of broken-down blood-coloring matter.

ELIMINATION.—The drug is eliminated by the kidneys as para-amido-phenol sulphate, and is entirely passed out of the body in about twenty-four hours.

Antiseptic Action.—Acetanilid possesses distinct antiseptic powers, but is not capable of acting as a disinfectant. (See Therapeutics.)

Toxic Changes From Prolonged Use.—Although it has been asserted that no untoward effects result from the constant and prolonged use of acetanilid in large doses, there can be no doubt that this assertion is untrue. Used constantly in excess, congestion of the liver, kidneys and spleen occurs, and if the dose be poisonous, clots may be found in the cardiac cavities. There may be also a progressive decrease in the number of the red blood corpuscles. On the other hand the popular idea that its fairly frequent use is deleterious is in the great majority of cases false.

Poisoning.—In man this drug in toxic quantity causes the lips to become blue and the face livid, cyanosed, expressionless, or anxious. The forehead and cheeks become covered with sweat, which gradually extends over the rest of the body. The pulse is soft and compressible, but slow, and finally very weak. The respirations become slow and shallow.

The treatment of a case of poisoning by acetanilid should consist in supporting measures, the use of stimulants, external heat, belladonna to maintain blood-pressure, strychnine to aid the respiration, and oxygen inhalations if they are necessary to combat cyanosis.

Therapeutics.—The employment of acetanilid in fevers must depend very much upon the condition of the patient and the character of his disease. The mere existence of a high temperature is not, correctly speaking, an indication for any antipyretic remedy. The phase of the disease must be recognized, and the question as to whether the fever which is present is harmful must be duly weighed. (See Treatment of Fever, Part IV.)

In *typhoid fever*, though the drug possess decided antipyretic power, it often causes great depression and collapse, and in no way influences favorably the duration or general course of the disease.

For the same reasons the use of acetanilid in *phthisis* is inadvisable, for, although it greatly affects the hectic fever, it is very apt to cause collapse, profuse sweating and depression. Thus, the writer has repeatedly seen cases of phthisis in which the attempt to control the fever by this drug resulted in the symptoms just named; and Riese points out, what the author has also noted, namely, that in this disease cyanosis is very apt to come on after the use of the drug.

In regard to the employment of acetanilid in *sthenic fevers*, it at once becomes evident that a drug absolutely unsuited to a case of asthenic disease may, on the other hand, agree with a sthenic-fever patient very well. In consequence of this, we find that the sweating produced by acetanilid is not so marked or troublesome in diseases of a dynamic type, and that, in consequence, it more rarely causes collapse; but even in this class of cases, and particularly in both varieties of pneumonia, the use of acetanilid is rarely advisable. Indeed, the antipyretic use of this and similar compounds is yearly becoming less and less.

In much the same manner that antipyrine was found, some time after its introduction, to be possessed of pain-relieving power, so acetanilid has been discovered to possess similar properties. Almost every form of nerve pain seems to indicate its employment. It has been successfully used in the crises of *ataxia*, the severe dartings of *neuralgia*, in cases of *sciatica*, and severe *headaches* often yield to its influence. Experience has proved it to be of value in *epilepsy*.

The employment of acetanilid in *acute rheumatism* may be separated, if desired, into that devoted to the relief of pain and the reduction of pyrexia. There can be no doubt whatever of the ability of the drug to control the fever of this disease, and the question as to whether it favorably influences the severity of the pain of the malady is to be answered strongly in the affirmative. It is not curative. (See Rheumatism, Part IV.) The dose for cases of *rheumatism* should be 4 (0.25) to 6 (0.4) grains three times a day. In *subacute rheumatism* of the muscular type, acetanilid will often give marked relief.

Acetanilid in dry powder is of value in the treatment of *chancroids*, and in the antiseptic dressing of *wounds* when used alone or with equal parts of borax.

In many cases of *obstinate vomiting*, particularly that following surgical operations when an anesthetic has been used, acetanilid is a useful remedy. The drug is usually best given in the dose of 1 grain (0.06) every half-hour until 6 grains (0.4) have been taken; and the following prescription may be used in compressed tablet, pill, or powder, preferably the latter, in order to increase the sedative effect on the stomach.

℞—Acetanilidi . . . . gr. vj (0.4)
Fiant pilulæ vel chartulæ, No. vi.
S.—Wash down with a little water or else dissolve powder in a dram of brandy, pour over cracked ice and give it slowly from a spoon.

Acetanilid has been recommended as a local hemostatic in *epistaxis,* and has been given internally with asserted advantage in *hemoptysis.* This use is probably erroneous.

Acetanilid distinctly increases the susceptibility of a patient to cold, and for this reason it should not be used for the relief of neuralgic or other pain before leaving the house in cold weather if it can be avoided.

Incompatibility.—Acetanilid is decomposed by strong alkalies, and alkaline iodides and bromides in aqueous solution precipitate it. It forms a soft mass or liquid with hydrated chloral, with phenol, resorcinol, thymol and antipyrine.

Untoward effects are not common if acetanilid be used with care. The writer has collected a number of cases (38) in which unfavorable signs appeared after its use, but untoward action was never seen unless the dose given was excessive for the case which received it. The dose most commonly producing such symptoms was from 3 (0.2) to 10 grains (0.6). In only 3 instances of the series did death occur—1 from heart clot and 2 from *excessive* dosage. No deaths were reported from moderate amounts, although some of the cases were alarming. Very rarely symptoms of poisoning by acetanilid, such as are described above, follow its general use as a dusting-powder over wounds and other breaks in the skin.

Administration.—Acetanilid may be given in doses varying from 2 (0.12) to 10 grains (0.6), the last-named amount being usually excessive. As it is virtually insoluble in water, it is usually administered in powders, capsules or tablets. The antipyretic effect is manifested about one hour after the drug is taken. When neuralgias are to be treated or similar forms of pain are present, one of the bromides, in the dose of 10 grains (0.65), may be combined with acetanilid with advantage.

This drug is not to be used if there is reason to believe that marked renal congestion or irritation is present.

ACETARSONE.

(SEE STOVARSOL).

ACETIC ACID.

Acidum Aceticum, U. S. and B. P., is a clear liquid, composed of not less than 36 per cent nor more than 37 per cent of glacial acetic acid, having a strong characteristic, vinegar-like odor, a sharply acid taste, and a strongly acid reaction. Miscible with water or alcohol in all proportions. It is obtained from wood by destructive distillation, or by the oxidation of ethyl alcohol.

Acetum, or Vinegar, is practically dilute acetic acid.

Therapeutics.—Acetic acid is seldom used internally. The glacial or absolute acetic acid (*Acidum Aceticum Glaciale,* U. S. and B. P.) is used as a powerful escharotic. It may be applied to *warts* and other growths, and to old *sores* where the granulations are profuse and healing is slow. The dilute acid (*Acidum Aceticum Dilutum,* U. S. and B. P.) is used as a lotion in *night-sweats* and to arrest *epistaxis* and other minor hemorrhages. When employed as a lotion it should be diluted one-half with water. Vinegar, or dilute acetic acid, has been used internally to decrease *obesity,* but is a harmful and useless remedy, disordering digestion and reducing the patient's strength.

Inhalation of vinegar fumes from a cloth saturated with this liquid sometimes will control *vomiting* after the use of an anesthetic.

In the following mixture acetic acid may be used for the removal of vegetations about the external genitals:

℞—Acidi salicylici	gr. xxx (2.0)
Acidi acetici	f℥j (30.0).—M.

S.—Apply with a camel's-hair brush.

Only slight pain is caused by this application.

Poisoning.—When overdoses of acetic acid are taken, the treatment consists in the use of large draughts of milk, alkaline liquids, such as lime-water, soap-water, etc., and the general measures suitable for the treatment of gastro-enteritis. (See Gastro-enteritis, Part IV.)

Contraindication. — Nursing mothers should not take freely of vinegar, as it may produce a troublesome diarrhea in the nursling.

ACETPHENETIDIN (PHENACETIN).

Phenacetin (*Acetphenetidinum,* U. S.; *Phenacetinum,* B. P.) is a coal-tar product introduced several years ago as an antipyretic of the same character as acetanilid. It occurs in white, glistening, crystalline scales without odor or taste. It is only slightly soluble in water. Acetanilid and antipyrine are sometimes substituted for phenacetin. Pure phenacetin when shaken with nitric acid is colored yellow, which color persists when it is heated. This is not the case with the other products named.

When this drug is carelessly made, an impure product is the result, which produces irritation of the kidneys, and, in consequence, causes grave complications. Reuter states that the impurity may be discovered by placing a small amount of chloral hydrate in a test-tube, melting it at a temperature just sufficient to liquefy it, and then adding the suspected sample of phenacetin in the proportion of one-fifth. If the phenacetin is impure, it will become purple, then red, and finally blue.

Physiological Action.—Unfortunately, our knowledge of the physiological action of phenacetin upon the nervous system is not so thorough as is desirable. We know, however, that it is a distinct nervous sedative, and that it acts particularly on the spinal cord in its sensory tracts.

Upon the circulation the drug has little or no effect unless given in doses exceeding those generally employed, or continued in overdose for some time. The blood after the ingestion of these doses becomes dark and blackish from the formation of methemoglobin, and the urine becomes dark yellow and reacts with Fehling's solution. Upon normal bodily heat and the heat of fever the drug exerts a depressing effect, decreasing the production and increasing the dissipation of heat.

Therapeutics.—Our knowledge concerning the influence of phenacetin upon the human body in disease may be divided into two separate parts in much the same manner that we divide the uses of acetanilid—namely, its uses as an antipyretic and as an analgesic.

The remarks made in the article on Fever (Part IV) clearly show why phenacetin should not be used as an antipyretic, for every drug used as an antipyretic is, as a rule, deleterious. It is far better to reduce the fever with cold applications. (See Cold in Fevers, Part III.)

Upon the nervous system phenacetin acts as an antineuralgic, and is of service in *migraine* and ordinary *headache* from *eye-strain,* in the pains of *tabes dorsalis,* in *intercostal neuralgia,* and in *rheumatism.* Sometimes it relieves these troubles when antipyrine fails. Altogether we may consider phenacetin a rival of antipyrine in the power to relieve pain.

For neuralgia the following prescription may be ordered:

℞—Acetphenetidini	gr. xx	(1.3)
Caffeinæ citratæ	gr. x	(0.65)
Strontii bromidi	gr. xxx	(2.0).—M.

Pone in capsulas, No. v.
S.—One or two capsules with water every hour while the pain lasts.

In *subacute rheumatism* and in the lumbar or muscular pains of *influenza* a powder or pill of 4 grains (0.25) of phenacetin and 5 grains (0.3) of salol, given three or four times a day, is most efficient.

Under the name "*Lactophenin,*" a nearly related compound of phenacetin is sometimes used for the same purposes. In phenacetin one atom of hydrogen is replaced by an acetic-acid radical; in lactophenin this atom of hydrogen is replaced by a lactic-acid radical. Similarly "citrophen" is made by replacing the atom of hydrogen by a citric-acid radical. It is also used as a substitute for phenacetin.

The dose of these drugs is about the same as that of phenacetin, or a little larger, about 5 to 10 grains (0.3–0.6) three times a day.

ACETYL-SALICYLIC ACID.

Acetyl-salicylic acid (*Acidum Acetylsalicylicum,* U. S. and B. P.), sometimes called Aspirin, owing to its chemical constitution has been introduced into medicine as a substitute for the ordinary salicylates; as it is dissolved and absorbed in the bowel, as is salol, it is said not to irritate the stomach. Unless well diluted, however, it causes gastric distress. It is not so disagreeable to the taste as are most of the salicylate preparations, and it is claimed is less likely to cause tinnitus. The dose of acetyl-salicylic acid as a remedy for *acute rheumatism* is 10 to 15 grains (0.65–1.0) four times a day or oftener. It is also used in lithemic or gouty states in place of the older salicylates. It may also be employed as an *intestinal antiseptic.*

Its most general use, however, is for the relief of *neuralgic pain.* Acetyl-salicylic acid may be applied, by means of dipping an applicator covered with wet cotton in the finely powdered drug, with excellent results in the early stages of *tonsillitis.* The applications should be made every six hours or as a gargle, 2 tablets to 3 ounces of water. This form of treatment is probably the most efficient means of relieving pain after tonsillectomy.

A combination of acetyl-salicylic acid with quinine sulphate is often used in cases of influenza. It is efficient, but must be made up freshly and not kept over a long period, as it develops a toxic substance in the presence of heat and moisture.

ACOINE.

Acoine is a synthetic substance introduced into ophthalmic surgery as a local anesthetic and antiseptic. It is used in a 1 or 2 per cent solution. It is a powerful anesthetic to the conjunctiva, but does not anesthetize the cornea and for this reason is useless when foreign bodies are to be removed from the cornea.

ACONITE, OR MONKSHOOD.

The aconite of the U. S. and B. P. is the dried root of *Aconitum Napellus* Linné.

Aconite is indigenous in Germany, France and Switzerland, and is cultivated as a garden plant in Europe and America. The root resembles so strikingly that of horseradish as to be readily confused with that condiment, but does not emit the pungent fumes of the latter when it is scraped or broken. It is also to be remembered that aconite produces a sensation of heat in the mouth when chewed. The active principle upon which the therapeutical value of aconite would appear to depend is aconitine, but there is reasonable doubt whether this can be relied upon as completely as the preparations of the crude drug; the aconitine of commerce, moreover, varies very much in strength, because some of it is amorphous and impure, while other samples are pure and crystalline. Further than this, even the crystalline form is exceedingly variable in strength. In addition to aconitine, Dunstan asserts that there are two amorphous alkaloids—namely, benzaconine and

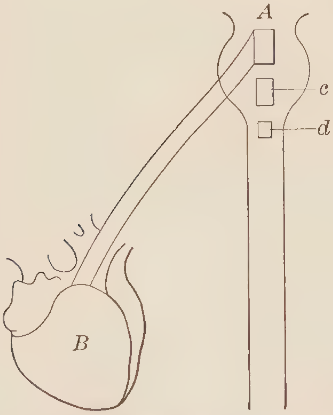

Fig. 5.—*A*, vagus center stimulated by aconite, which slows pulse; *B*, heart muscle depressed, which slows pulse; *c*, vasomotor center depressed, which lowers arterial tension; *d*, respiratory center depressed.

aconine. Aconitine is 200 times as toxic as benzaconine and 2000 times as toxic as aconine.

Physiological Action.—When aconite is placed on the tongue it produces a sensation of tingling and burning which extends over the pharyngeal surface, and into the stomach if the drug is swallowed. This is due to its primary irritant and secondary benumbing action on the sensory nerve-endings of the mucous membrane. It sometimes causes a sensation of constriction in the fauces.

NERVOUS SYSTEM.—In full medicinal dose aconite depresses the functional activity of the sensory side of the spinal cord, but chiefly depresses the peripheral ends of the sensory nerves.

CIRCULATORY SYSTEM.—When aconite is given in moderate medicinal dose it exercises no marked effect on any part of the organism save the circulation, which becomes somewhat slower from stimulation of the vagus centers and by the drug acting as a sedative to the heart muscle itself. This cardiac slowing has been denied by Price, but my experience is that it does occur. The arterial pressure is slightly decreased by these doses, chiefly by the decrease in cardiac force. If large doses are used, the heart becomes still more feeble and slow, and the arterial pressure falls from this cause and from depression of the vasomotor center. When a poisonous dose is given, it causes first a marked fall in pulse-rate and arterial pressure, preceded sometimes by a quickening due to a condition of weakness and abortive cardiac action: this condition gradually passes into diastolic arrest of the heart, the viscus becoming paralyzed and refusing to respond to stimuli.

RESPIRATION.—In moderate doses aconite quiets the respiratory movements slightly, particularly if the breathing is hurried. In poisonous doses it paralyzes the respiratory center and so causes death.

TEMPERATURE.—Aconite acts as a distinct reducer of fever, probably because of increased heat radiation arising from relaxation of the capillaries and impaired circulation.

ABSORPTION AND ELIMINATION.—Aconite is rapidly absorbed and destroyed by oxidation, so that its effects do not last for any length of time. The effect of aconite when given in a large medicinal dose lasts for about three hours. It usually increases the urinary flow.

Poisoning.—When aconite is taken internally in excessive amount, it causes tingling of the mucous membranes wherever it touches them, which sensation finally amounts to severe burning. This soon passes away, and is followed by a sense of tingling about the lips and finger-tips or all over the skin. At the same time the patient feels relaxed; the pulse at first becomes weak and slow, but later may be rapid and running, so that it seems a mere trickle under the finger; sweating is more or less marked and fainting may ensue. Vomiting may occur, but is rare. The respirations now become slow and shallow, seeming to expand the lung to the smallest possible extent consistent with life. The face is pallid and anxious. Consciousness is preserved unless lost through an attack of syncope. There may be exophthalmos, or the eyes may be sunken and dull. The sclerotic is pale and pearly-looking. There is excessive pallor of the face. Clonic convulsions of unknown origin sometimes occur. There may be marked anesthesia of the skin. The pupils may be normal, contracted, or dilated widely. The temperature of the body is subnormal. Death may be gradual or sudden, the slightest movement of the body which throws any strain on the heart stopping that organ in diastole.

TREATMENT OF POISONING.—The patient is to be placed on the back on a bed or board, with the feet higher than the head, in order to confine the circulation as far as possible to the vital centers at the base of the brain. Hot bottles or bricks are to be placed about the body for the purpose of maintaining the bodily heat. Emetics are not to be given if the symptoms are severe, as vomiting may cause cardiac failure, owing to the muscular effort involved, or the stomach may be so depressed that emetics will not act. If vomiting comes on, the vomitus should be received into a towel, the patient not being allowed to raise his head. The stomach is to be washed out by means of a stomach-pump or a siphon of rubber tubing. Ether may be given hypodermically, spirit of ether, or aromatic spirit of ammonia, by the mouth, and this followed by digitalis. Full hypodermic doses of strychnine, such as $\frac{1}{20}$ to $\frac{1}{10}$ (0.003–0.006) grain, should be given to stimulate the respiration and heart. The ether acts at once, and stimulates until the digitalis, which is the physiological antagonist of aconite, but slow and more prolonged in its effects, asserts itself. Atropine, because of its stimulating effect on the vasomotor system, may also be used. If the breathing fails, artificial respiration is to be employed, or if the heart seems about to cease its action, a whiff of nitrite of amyl may start it going again; but only a few drops of the nitrite should be used, as large amounts depress this organ.

Untoward Effects.—Aconite when applied locally or taken internally may cause in susceptible persons a vesicular, or even a pustular, eruption, or instead an intense itching of the skin may be developed.

Therapeutics.—Aconite is used chiefly for its influence as a cardiac and circulatory sedative, for its effects on the peripheral sensory nervous system, as in the *vomiting of pregnancy*, and in those states in which, through inflammation elsewhere, the nervous system needs a sedative which will simultaneously reduce arterial tension. In the *early* stages of all *acute inflammations* aconite may be of service. Aconitine may be applied locally over superficial nerves in *neuralgia* in the form of an ointment (2 grains [0.12] to 1 drachm [4.0], or as the oleate of aconitine, 2 grains [0.12] of the oleate to 100 [6.6] of sweet oil). In the earlier stages of *gonorrhea* aconite in small doses frequently repeated is a valuable remedy, and later in the disease tends to prevent *chordee* by its influence on the nervous centers. It is useful in *croup, quinsy, sore-throat, severe colds, bronchitis,* and *asthma* due to exposure, in their early stages. When *suppression of menstruation* follows exposure to cold, this drug given with a hot drink and a hot sitz-bath, will often restore the flow. In *pericarditis* it is valuable to allay the inflammation and quiet the excited heart. Aconite is by far the best circulatory and nervous sedative for children in the earliest stages of the sthenic fevers, particularly of the irritative type.

℞—Tincturæ aconiti		♏xx (1.3)
Spiritus ætheris nitrosi		f ʒij (8.0)
Liquoris potassii citratis	q. s. ad	f ℥ij (60.0)

S.—Teaspoonful (4 cc) in water every hour or two for a child of five years.

Aconite ought not to be used in adynamic, asthenic affections. It is harmful in prolonged acute diseases, such as scarlet fever, if constantly employed.

In some persons who suffer from *asthma* which is preceded by coryza, aconite does good if given in the earliest stages.

In *nervous palpitation of the heart* and in the palpitation of *excessive cardiac hypertrophy* aconite is valuable. In many cases of this character, where there is not only hypertrophy but also impaired innervation, the use of a prescription containing aconite and digitalis proves of service, for the moderate doses of digitalis stimulate the vagus nerves, and the aconite not only steadies the heart by its stimulant effect on the vagi, but also prevents an overstimulant effect of the digitalis on the heart-muscle:

℞—Tincturæ aconiti		f℥ss (15.0)
Tincturæ digitalis		f ʒij (8.0)
Tincturæ belladonnæ foliorum		f℥ss (15.0)
Tincturæ gentianæ compositæ	q.s. ad	f ℥iij (90.0).—M.

S.—Teaspoonful every six hours.

In the *epistaxis* of full-blooded people aconite often affords great relief.

Administration.—As a general rule, small divided doses of the drug in the form of the tincture, 2 to 4 minims (0.1–0.2) given every fifteen minutes, will act better than a full dose given at once, unless the condition of the patient requires very active treatment.

Preparations.—*Tinctura Aconiti,* U. S., is used in the dose of 3 to 20 minims (0.2–1.3). The tincture of the U. S. P. of 1920 is only 10 per cent strength instead of 35 per cent in former days. The dose of the B. P. tincture is 2 to 5 minims (0.12-0.3). A very useful way of employing it is in the form of tablet triturates. The extract of aconite (*Extractum Aconiti*) is given in the dose of $\frac{1}{4}$ to $\frac{3}{4}$ grain (0.015–0.045). The fluidextract (*Fluidextractum Aconiti,* N. F.) is given in the dose of 1 to 2 minims (0.06–0.12). Fleming's tincture ought never to be used. The dose of the active principle aconitine

(*Aconitina*, U. S. and B. P.) is $\frac{1}{400}$ to $\frac{1}{200}$ grain (0.00015 0.0003), but it ought never to be used internally. The B. P. preparations that are not official in the U. S. P. are aconitine ointment (*Unguentum Aconitinæ*) and aconite liniment (*Linimentum Aconiti*).

ACRIFLAVINE.

Acriflavine hydrochloride (diamino-methyl-acridine mono-hydrochloride) occurs as a reddish-brown crystalline powder possessed of distinct antiseptic properties. It is soluble in water 1 to 5. Strong solutions are brown, but dilute ones are lemon-yellow with a greenish tint. Solutions should be freshly made. Its antiseptic powers are noteworthy in that it acts particularly efficiently in the presence of serum. It is claimed that acriflavine does not impair phagocytosis.

Acriflavine is commonly used in the strength of 1 to 1000 in normal salt solution in *fresh wounds* to prevent infection developing and for the irrigation or swabbing out of suppurating wounds, employing it once or twice daily. A considerable amount of the solution may be left in the wound or it may be packed with gauze wet with the solution. In some instances, particularly as the condition progresses favorably, the solution may be reduced in strength to 1 in 5000. It has been used successfully in cases of *gonorrhea* by urethral irrigation in the strength of 1 to 3000 once a day or 1 to 3500 to 1 to 2500 by injection twice a day. To disinfect skin before operation use 5 per cent. Solutions should be freshly prepared. It is not necessary to remove it from the skin after it is applied in surgery as it does not irritate, but the skin should be well scrubbed and washed with alcohol and ether before it is applied to remove grease from the glands of the skin.

Staining of the skin by acriflavine may be removed by washing the part with very dilute sulphuric or hydrochloric acid followed by plain water, or 3 per cent hydrogen peroxide.

Neutral Acriflavine.—Acriflavine base, has been introduced in order to avoid the somewhat irritant properties of the original drug. This modification is accomplished by manufacturing a product from which the molecule of hydrochloric acid is removed. Neutral acriflavine has now almost supplanted the older drug as it is practically neutral in reaction and can be used in greater strength solutions. It is employed for the conditions named above and, when given by the mouth, as a urinary antiseptic in the dose of $\frac{1}{2}$ to 1 grain in enteric-coated tablets three times a day. Neutral acriflavine has been used with success when given intravenously in the early stages of *epidemic encephalitis*. The average dose has been 10 cc. of a 0.5 per cent solution, given over a period of five minutes, every day until improvement takes place. In the dose of 0.2,0.3,0.4 grains in 1 to 100 normal saline at intervals of two or three days it is recommended in *undulant fever*. Solutions of 1 to 1000 are used as a mouth wash in *Vincent's angina*.

ADALIN.

(SEE CARBROMALUM, U. S.)

ADONIS VERNALIS.

From *Adonis vernalis*, a plant indigenous in Europe and Asia, is derived a glucoside, Adonidin. When given to one of the mammalia —the dog, for instance—it causes an increase in heart force and a rise of arterial pressure. In the frog poisonous amounts arrest the heart in diastole.

The indications for the use of adonidin are all conditions of cardiac failure, particularly the presence of *cardiac dropsy*. It is much inferior to digitalis and caffeine, but may be employed when these fail, as it sometimes succeeds under such circumstances. Adonis vernalis and the bromides have been combined in the treatment of *epilepsy* with asserted success

The dose of adonidin is $\frac{1}{8}$ to $\frac{1}{4}$ grain (0.008–0.015), three times a day; or 4 to 8 parts of the plant—all portions of which are employed —may be added to 180 parts of water, and of this infusion $\frac{1}{2}$ ounce (16.0) may be given every four hours.

AGAR.

Agar, U. S., is a gelatinous substance obtained in Japan from several species of seaweed that grow on its coast. It is identical with the agar-agar used in the bacteriological laboratory and is used in medicine as a remedy for *constipation*. It possesses no physiological activity, so far as the general economy is concerned, and it does not exercise any true medicinal effect upon the intestine. By absorbing moisture it becomes swollen and soft and, by adding to the bulk of the intestinal contents, indirectly acts as a laxative in much the same type of cases as that in which mineral oil now is used. While it is of the nature of a carbohydrate, Mendel and others have shown that it is not attacked by the digestive ferments or the intestinal bacteria. Probably its greatest sphere of usefulness is in those cases of constipation in which the stools are unduly dry. Agar appears as a coarse granular powder, and is given in the dose of from 1 to 2 heaping teaspoonfuls, or even 1 to 2 tablespoonfuls once or twice a day, eaten dry or mixed with some cereal or breakfast food. It can also be used in bread and biscuits. Under the name of chocolate agar a preparation is on the market, flavored with chocolate and fortified by cascara.

ALCOHOL.

Ethyl Alcohol (*Alcohol* or *Ethanol*, U. S.) is the alcohol used in medicine. The employment of the word "ethanol" is unfortunate because it is so readily confused with the word methanol which means wood alcohol, that accidents are prone to occur. Some of the other alcohols are exceedingly poisonous. Amylic alcohol is fusel oil.

Alcohol is a liquid resulting from the fermentation of starches or sugars in the presence of heat. It is official in three forms—as *Alcohol*, U. S., containing 92.3 per cent by weight of the spirit and 7.7 per cent of water; *Alcohol Dehydratum*, U. S., and *Alcohol Absolutum*, B. P., with not more than 1 per cent by weight of water; and *Alcohol Dilutum*, U. S., or dilute alcohol, 41.5 per cent by weight of spirit and the remainder water. The drug is generally given in the form of whisky or brandy, and when the word alcohol is used in the saying, "Give the patient alcohol," one of these two liquids is always meant unless it is otherwise stated.

Notwithstanding the almost universal use of alcohol as a stimulant by the laity and the medical profession, it cannot be denied that evidence of scientific character and weight is constantly being brought forward which shows that its dominant action is sedative upon all parts of the body. Under its influence the total amount of mental work accomplished in a given space of time is less than when it is not taken, and the quickening of the pulse under its influence is not an evidence of strength. Nevertheless clinical experience, too great to be ignored, stands for the continued employment of the drug. The drug does not act as a stimulant in the ordinary sense of the term, but provides energy and readjusts the circulation by dilating the peripheral vessels and influences the protective powers of the body by affecting the blood cells or the blood serum or the lymph. This belief seems to find support by reason of experiments carried out by the author, in which he was able to show that alcohol produces a distinct increase in the bacteriolytic power of the blood in disease, probably by increasing the activity of the complemental bodies. These facts explain the good results which follow the use of the drug in clinical medicine. (See below.)

Physiological Action.—NERVOUS SYSTEM.—Alcohol never acts as a true stimulant to the brain, the spinal cord, or the nerves. On the contrary, its dominant influence is sedative and this sedative action in many cases is precisely what is desirable. The increased activity of thought and speech after its use is not due to stimulation, but to depression of the inhibitory nervous apparatus. The activity is therefore that caused by lack of control. It does not increase the vigor of thought nor its depth, or does it enable a man to work out a problem which is difficult. On the contrary, it rather benumbs the activity of mental processes. It does not increase efficiency in those who are normal, but it may do so in those who because of nervous excitement need a sedative effect. The effect of moderate doses differ from the effect of large ones in degree, but not in kind. To express the point in more scientific terms, it is recognized today that the emotions are largely controlled by the thalamus and the thalamus is controlled by the cortex. If the cortex is made less active the thalamus is uncontrolled. On the other hand, when the cortex is irritable from fatigue or other causes alcohol may be useful to quiet it. Reflex action may be increased by the same depression of inhibition, but not by reason of any true stimulation of the cord. In large doses it produces lack of coördination by depression of the brain and lower nervous system, the loss of coördination being due largely to impairment of sensation, so that the sense of touch and the muscle sense are interfered with. This effect makes a drunken man fail to recognize the angles or uneven surface of surrounding objects, and the impaired mental power and disordered judgment, combined with the imperfectly acting motor and sensory pathways, cause him to stumble and fall.

Circulatory System.—Careful scientific research has proved that alcohol is in no sense a true stimulant to the circulation in healthy persons. Given in such a dilute form so that it cannot act as a local irritant to the stomach, it produces no change in pulse-rate or pulse-force. If the dose is large enough to cause any appreciable change in the activity of the circulation, it is in the nature of depression rather than stimulation. This is true in the laboratory and at the bedside. The effects of a single dose are not to be confused with those produced by moderate continued doses for in such instances the drug being readily oxidized gives energy when it is needed because fever is exhausting the vigor of the patient or old age is doing so. Alcohol does, moreover, produce very marked alterations in the distribution of the blood, as is seen in the flushing of the capillaries of the skin after its moderate use. In other words, it does not affect all the blood-vessels in a similar manner, for while the cutaneous vessels are dilated, those of the muscles are contracted, as are also those of the splanchnic area. Part of the beneficial action following the use of alcohol in disease, when it is thought to act as a stimulant, probably depends upon the improved distribution of blood it produces, just as the use of the sponge bath or cold plunge in typhoid fever readjusts the circulation and restores vascular tone. Little if any effect is exercised by alcohol upon arterial pressure when given in medicinal dose. In very large toxic doses alcohol depresses and finally paralyzes the heart and vasomotor system.

Respiration.—Respiration is not materially affected by alcohol.

Temperature.—Alcohol never increases the number of heat units in the body, for though in its oxidation more heat is made than when no alcohol is used, the increased radiation, or loss of heat, from the skin and lungs under its influence more than counterbalances the gain caused by the drug.

By its irritating effect on the mucous membrane of the mouth and stomach it produces a sensation of warmth, and warms the extremities at the expense of the body by increasing the circulation of blood in those parts. This increase in the peripheral circulation is due to an increase in the rapidity of the flow of blood and to dilatation of the peripheral capillaries. If it be used to excess, the temperature rapidly falls, owing to the increase of heat radiation produced by the free distribution of blood, as has just been described, and secondarily by the depression of the vital forces, for in overdose alcohol always acts as a depressant.

Bodily Metabolism.—The quantity of carbonic acid given off by the body under the use of alcohol is not materially altered. Some observers have noted an increase, some a decrease, and some no change at all when alcohol is taken. These results have probably depended upon the work required at the time the alcohol is in the body, for the influences of exercise and rest are potent factors in determining the activity of combustion or oxidation processes in the economy. The use of moderate doses of alcohol by a healthy man at first increases the loss of nitrogen, but after two or three days this effect passes off and there is a decrease in nitrogenous loss, the oxidation of the alcohol saving the tissues. Atwater and Benedict have shown that, owing to the ability of the body to oxidize alcohol, this liquid substitutes itself for the oxidation of fats and so saves tissue waste. The general effect of alcohol is, therefore, to conserve the body fat and the body proteids as well. That is to say, alcohol, by being burned up in the body, yields energy and saves tissue which would otherwise be oxidized if no alcohol were taken. To express it in still another way: alcohol, by its oxidation, adds force, not tissue, to the body, and by protecting the fats and proteids of the tissues from oxidation it may help maintain weight or even cause an increase in weight if it is properly utilized by the body. Not only is it readily oxidized but it is to be recalled that 1 ounce of whisky of 45 per cent alcohol contains about 100 Calories, that 1 ounce of protein or carbohydrate equals 120 Calories and 1 ounce of fat 270 Calories or heat units. Mellanby has pointed out that alcohol acts best if metabolic processes are started off by carbohydrates and proteins, which means it does best in the body if taken with food. He has also shown that a man can oxidize about 10 cc. of pure alcohol an hour or from 8 to 11 ounces of whisky in sixteen hours.

Many researches have been made to determine whether the habitual use of alcohol is deleterious to offspring. It has been claimed that as alcoholics have more degenerate children than non-alcoholics, that this is evidence of such an evil effect, when as a matter of fact, the parent, or parents, were primarily degenerate or they would not be alcoholics. A notable research on guinea-pigs by Stockard seemed to show, after many months, that alcoholism produced degeneration in offspring, but continuing his studies months longer he found that the offspring of the surviving guinea-pigs showed excellent development because alcohol had eliminated all except the very strongest who then because of their high vitality improved the breed.

This book is not the place for a discussion of the sociological aspects of the use of alcohol, but enough will be found in these pages to indicate that alcohol taken in youth, when nutritional processes are unimpaired, is usually harmful. Alcohol taken by those who are devitalized by old age or by disease is advantageous. Youth needs no artificial food or nervous sedative. In moderate amounts, when taken by a person who is unduly fatigued by some mental or physical toil, it overcomes nervous irritability, and by giving energy enables him to digest and assimilate his food. Old age and the man weakened by illness often needs something which is easily utilized for energy to support the system and make life easier.

Elimination.—Alcohol is rapidly absorbed and rapidly destroyed by, or eliminated from, the body. In medicinal doses it is largely "burnt up;" but when taken in excess of the body's oxidizing power it is eliminated as alcohol by the lungs and by the skin, kidneys and intestines.

Digestion.—Alcohol added in any amount to food in a test-tube containing digestive ferments retards or inhibits digestion, but in the stomach, on the other hand, when used in moderation, it assists the process; for by reason of its irritant and stimulating properties it induces the secretion of the digestive juice. This statement has been proved correct by Kast, who gave alcohol to a human being with gastric fistula. Further than this, the presence of alcohol in moderate amount in the stomach aids absorption by stimulating the mucous membrane. By inducing a sense of comfort and dispelling anxiety it may aid digestion, for anxiety and worry impair digestion. When excessive amounts are ingested it disorders digestion by inhibiting the action of the digestive ferments.

Therapeutics.—The chief use of alcohol is as a provider of energy and as a rapidly acting equalizer of the circulation in all forms of *circulatory failure* with feebleness due to low fevers and prolonged wasting diseases, in old age, and in convalescence from acute disease. In both croupous and catarrhal pneumonia, when these affections occur in alcoholics (see Pneumonia, Part IV), alcohol is useful. In *pneumonia,* in one accustomed to its free use, it is often essential.

Some additional conditions, to state them specifically, in which alcohol is indicated are *fainting, sepsis* and *excessive wasting* due to prolonged suppuration. It is also useful in many cases of *sepsis* combined with quinine and iron.

Alcohol should never be given in the presence of circulatory excitement, but whenever the circulation fails during the progress of a chronic disease it is useful. In the *catarrhal pneumonia of children,* brandy or whisky is very useful in the dose of 5 to 60 minims (0.3–4) every two hours in a little water or milk when the circulation seems feeble. (See Administration.) In exhausting fevers, such as *typhoid* or *typhus,* alcohol finds its true usefulness. While it may be needful to give alcohol in some cases of enteric fever from the beginning to the end of the attack, for the double purpose of aiding digestion and of supporting the system, its administration should not be a mere matter of routine, but should be based upon clear ideas of the indications it is calculated to fulfil. If the pulse is weak and the patient seems to be sinking, or the appetite is failing and adynamia is a pressing symptom, alcohol is indicated; but if the pulse is good, and the passage of the patient through his illness is not a stormy one, alcohol should be excluded from the sick-room. Sometimes ordinary whisky or brandy will in severe typhoid fever disorder the stomach. The physician should then employ an old brandy or wine which has acquired by age an aroma which is called a "*bouquet.*"

The more dilute the alcohol the less is it intoxicating, because as it is slowly absorbed it is more readily oxidized hour by hour. Taken with milk it is more slowly absorbed than when used with an equal quantity of water and if there is much cream in the milk its absorption is still slower. Probably the best dilution in prolonged illness is about 6 per cent.

In *persistent vomiting* the use of small doses of good brandy poured on cracked ice will often do much good.

Alcohol is used less today than formerly, partly because all drugs are given more cautiously, but chiefly because the diseases in which it often did great good, as, for example, typhoid fever, are less severe and far less frequently met with.

Alcohol is not only of service internally, but is also useful externally as a wash or evaporating lotion over *bruises, inflamed joints* and *wounds* of a contused character. It acts as a cooling and antiseptic dressing. When used for its influence as a local antiseptic it acts best in the strength of 60 to 70 per cent by volume, as the presence of the 30 or 40 per cent of water, by softening the bacterial envelope, enables the alcohol to destroy the germ. Pure alcohol is therefore much less serviceable than the dilute form. Alcohol is also useful for washing the skin of invalids, and "salt and whisky" applied by rubbing is an excellent mixture to stimulate the skin of unhealthy persons.

Acute Poisoning.—In acute poisoning a tablespoonful of vinegar will often produce remarkable effects in restoring consciousness. How it acts is not known. In advanced poisoning by alcohol, with coma and total relaxation, external heat and hypodermic injections of digitalis and strychnine are indicated if the heart or respiration seems to be failing. Atropine should be administered to stimulate the vasomotor system if the skin is relaxed and clammy, and counter-irritation to the back of the neck is to be employed if any brain symptoms are present. The after-treatment consists in the use of substances stimulating to the stomach, such as ammonia, spirit of Mindererus, and spices, unless there is gastric inflammation, when emollient substances should be used to quiet the irritation. If persistent vomiting comes on, it must be quieted by the patient swallowing pieces of ice, or by minute doses of ipecac. Counter-irritation should be applied over the belly. If the emunctories are not acting freely, thorough purgation by jalap or elaterium (40 grains [2.6] of jalap powder or $\frac{1}{8}$ grain [0.008] of elaterium) should be employed; or full doses of calomel followed by a saline may be given if milder effects are sought. For the *morning vomiting* of drunkards Fowler's solution of arsenic is often a valuable remedy.

In view of the frequency with which alcoholic and opium poisoning are confused, the following table is appended, which will be found of value in making a differential diagnosis as to the condition of the patient.

Alcoholism and Opium Poisoning.

Alcoholism.	*Opium Poisoning.*
1. Pupils normal or dilated.	1. Pupils contracted.
2. Respiration nearly normal.	2. Respiration slow and full.
3. Face may be pallid.	3. Face suffused and cyanosed.
4. Skin cool, perhaps moist.	4. Skin warmer than in alcoholic poisoning.
5. Pulse rapid, at first strong, then weak.	5. Pulse slow, strong, and full till late in poisoning.

There is scarcely any difference as to consciousness in the two conditions.

In medico-legal cases the urine should be preserved in hermetically sealed vessels for examination.

Acute alcoholism and apoplexy are often confused. They are differentiated in the following table:

Acute Alcoholism and Apoplexy.

Alcoholism.	*Apoplexy.*
1. Pulse rapid, compressible and weak.	1. Pulse apt to be strong and slow.
2. Skin moist, or relaxed and cool.	2. Skin hot or dry.
3. Bodily temperature lowered.	3. Bodily temperature raised.
4. Pupils equally contracted or dilated; generally dilated.	4. Pupils unequal.
5. No hemiplegia.	5. Hemiplegia: one side moved, the other remaining motionless.
6. Breathing not so stertorous nor so one-sided in lips.	6. Respiration stertorous, the lips being inflated on one side on expiration
7. No facial palsy.	7. Facial palsy.
8. Unconsciousness may not be complete.	8. Unconsciousness complete.

The odor of alcohol in the breath is no guide, as acute alcoholism and the rupture of a cerebral bloodvessel may both be present.

Since the passage of the Prohibition Amendment to the United States Constitution, a majority of the cases of so-called alcoholic intoxication vary greatly in their symptoms from those heretofore caused by beverages containing ethyl alcohol, since various impurities induced by crude methods of distillation and toxic agents arising from attempts to use "denatured alcohol" are often the chief cause of illness. Deep stupor is perhaps the most common symptom, and suppression of urine is often present.

The question as to what is an intoxicating dose of alcohol has assumed increased importance in the United States under Prohibition. Much depends upon the form in which it is taken, the rapidity with which it is ingested, the state of the digestive organs as to activity and the presence of food and other drink, upon whether the individual is by idiosyncrasy susceptible or insusceptible to its effects and whether he is able to take it freely because he has trained his system to rapidly oxidize it. So, too, larger amounts may be taken if hard physical exertion is being carried on than if the patient is at rest. Taken in concentrated form it is obviously more severe in its effects than if the alcohol is well diluted, which in part explains the difference in the intoxicating effects of whisky and brandy on the one hand and beer on the other. Further, when taken well diluted, it is not only more slowly absorbed, but time is given for it to be oxidized or excreted before enough is present in the blood stream to produce intoxication. (See preceding text.)

According to the experiments of Schweisheimer, men in repose on a couch ingesting to the full capacity of their stomach a volume of red wine containing 10.35 per cent of alcohol by volume show the conditions generally recognized as intoxication or drunkenness when the alcohol content of the blood reaches a percentage of from 0.134 per cent to 0.153 per cent by volume.

Marshall, in two experiments with men, who reposed on a couch during the experiment, had each ingest within a period of ten minutes 1200 cc. (the full capacity of their stomach) of beer containing 2.75 per cent by weight of alcohol (equivalent to 3.49 per cent by volume). At intervals of one hour he determined the quantity of alcohol in the blood and found that the maximum quantity of alcohol in the blood of one man was reached at the end of the first hour after the ingestion of the beer and amounted to 0.035 per cent by volume, and in the other case at the end of the second hour after the ingestion of the beer amounted to 0.0325 per cent by volume. In a third experiment with a man not in repose, but engaged in his everyday activities, who had ingested 1200 cc. (the full capacity of his stomach) of beer containing 2.75 per cent by weight of alcohol (equivalent to 3.49 per cent by volume) and at intervals of one hour (except in the first period which was forty-five minutes) determining the quantity of alcohol in the blood, found that the maximum quantity of alcohol in the blood was reached at the expiration of forty-five minutes after the ingestion of the beer and amounted to 0.015 per cent by volume.

The quantities of alcohol in the blood in all three cases were far below the quantities established by Schweisheimer as necessary to produce intoxication.

The men upon whom the experiments were performed were aged between twenty-two and twenty-three years and were infrequent drinkers of alcoholic beverages. In no cases did the subject experience nausea or dizziness, and their mental faculties were perfectly clear throughout the experiment. Nor was there any unsteadiness of gait in walking.

The lethal dose of whisky is not determined. A few ounces may kill a child, whereas it is not uncommon for Polish laborers in this country to take as much as 2 or 3 quarts of whisky in a day without producing a condition approaching death.

Chronic Poisoning, or the Alcoholic Habit.—It has been shown by careful investigation that those who abuse alcohol, or opium and its derivatives, do not do so because these drugs primarily induce depravity, but, on the other hand, that natural weakness or depravity induce these excesses. Chronic poisoning by alcohol results in very characteristic changes in the tissues. As the liver receives the alcohol from the stomach diluted only by the portal blood, it is often affected very early, and cirrhosis of this organ comes on with its accompanying gastric and nutritional symptoms. Mental disturbances are common, and neuritis may develop and produce paralysis or symptoms resembling locomotor ataxia.[1]

Chronic alcoholics can take large amounts of alcohol without much immediate effect because of the fact that they develop an ability to oxidize the drug which is not possessed by the ordinary individual.

The treatment of chronic alcoholic poisoning may be carried out in two ways: First, by the isolation of the patient and the complete withdrawal of the drug at once; secondly, by a better plan, a gradual tapering-off in the daily amount of the spirit. In either instance isolation must be absolute, and all smuggling of alcohol to or by the patient prevented. The attendants must be absolutely trustworthy. Careful scrutiny of bedclothes and closets will often be rewarded by finding hidden whisky bottles. The depression of the patient when recovering from alcoholism must be met by the use of nutritious broths, highly seasoned in order to stimulate the stomach, by easily digested or predigested foods, and by small doses of digitalis or strychnine if the patient be very weak and need such a stimulus. Koumyss is an exceedingly valuable and nutritious preparation under these circumstances.

In the treatment of the *atonic stomach of drunkards* a valuable aid is to be found in the following pill:

℞—Oleoresinæ capsici	♏x (0.6)
Olei caryophylli	♏x (0.6)
Hydrargyri chloridi mitis	gr. xx (1.3)
Aloes purificatæ	gr. xl (2.6).—M.

Fiant pilulæ, No. xx.
S.—One three times a day after or before meals.

If this pill fails to move the bowels, a saline purgative may be used or 2 or 3 compound cathartic pills be given.

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[1] See author's Diagnosis of Disease, 9th edition. Lea & Febiger, Philadelphia.

The following are the principal points in the differential diagnosis of

Chronic Alcoholism and the General Paralysis of the Insane.

Chronic Alcoholism.	*Paretic Dementia.*
1. Attacks shorter, and more widely separated by intervals of sanity.	1. Attacks more prolonged.
2. Delirium may be of any character.	2. Delirium of grandeur more marked and defined.
3. Visions more characteristic, and are evil.	3. Visions often not evil, but pleasant.
4. Tremors confined to head and arms.	4. Tremors more diffused.
5. Tremors removed by dose of alcohol.	5. Tremors made worse by alcohol.
6. Mental symptoms temporarily removed, or at any rate improved, by alcohol.	6. Mental state made worse by alcohol.
7. Tremors occur chiefly in the morning.	7. Tremors not confined to the morning.

There is danger of pneumonia from failure of the right side of the heart in subacute and chronic alcoholism, and the physician should always be on the lookout for this complication.

Administration.—Brandy and whisky are generally used as a means of getting alcohol into the body. They should be exhibited in the form best adapted to the work they are intended to perform If the action must be immediate, as in a case of fainting, they should be employed *hot* and *concentrated*, so that the stomach has not to warm the liquid before absorption. They are to be used hypodermically if still more rapid action is required. If administered to aid digestion and support the system, then they should always be *given with the food*—never alone, and never concentrated. They may be given as milk-punch or as eggnogg, the latter being the "heavier" of the two so far as digestion is concerned. In fevers of a typhoid type the dose of whisky or brandy may be for an adult from ½ to 2 ounces (15.0–60.0) every three or four hours More than a pint in twenty-four hours is rarely required, but this amount often does great good and is not excessive if the patient is accustomed to its use and needs supporting treatment. When brandy or whisky is given to children, the following rules as to dosage may be used as indicating the approximate proper dose: 5 to 10 minims (0.3–0.6) every four hours for a child one month old; 10 to 20 minims (0.6–1.3) for a child two months old; 20 to 30 minims (1.3–2.0) for a child three months old; 30 to 40 minims (2.0–2.6) for a child over three months old; 60 minims (4.0) for a child over four months old. In some cases, however, it is well to use half these doses every two hours. In all cases the liquor should be diluted with warm or cool water. Wine-whey is very light and useful. Mulled wine and champagne are particularly useful in the treatment of irritable stomach. When milk punch is used care should be taken to shake the whisky and milk together before administering the mixture. Milk punch made with Jamaica rum is often useful. (See Foods for the Sick.) Champagne when used as a medicinal substance should always be as devoid of sugar as possible—that is, what is known as "extra dry" or "Brut." Gin is rarely employed as a stimulant, except when the kidneys are torpid. Stout and porter are of value in wasting disease, in convalescence from acute diseases, and for nursing women. Beer also may be so used and often acts as a tonic and appetizer.

Contraindications.—All states of cerebral excitement, unless due to exhaustion, acute inflammations, the alcoholic habit, apoplexy, meningitis, acute nephritis, acute gastritis, hepatic congestion or inflammation, contraindicate the use of alcohol, as does also the history of the alcoholic habit.

Preparations.—Dilute alcohol (*Alcohol Dilutum,* U. S.), pure alcohol (*Alcohol,* U. S.), and absolute alcohol (*Alcohol Dehydratum,* U. S., *Alcohol Absolutum,* B. P.) are official.

The commonly used preparations of alcohol are as follows:

Whisky (*Spiritus Frumenti,* U. S.) should be at least four years old, and be made, in America, from rye, for medicinal purposes, but the present U. S. P. permits it to be made of any cereal. Whatever its source it must contain not less than 47 per cent nor more than 53 per cent by volume of alcohol and must be at least four years old.

Brandy (*Spiritus Vini Vitis,* U. S.) is obtained by the distillation of fermented grapes or fruits, and should be from three to five years old before use. It must contain not less than 48 per cent nor more than 54 per cent by volume of alcohol.

Cologne Water (*Spiritus Odoratus*) is used solely as a lotion and perfume.

Red wine is made from grapes not deprived of their skins. White wine is the fermented juice of grapes the skins of which have been removed.

Rum is made from the fermentation of molasses, and contains about 40 to 45 per cent of alcohol.

Gin is made from rye or barley, with the addition of juniper berries and hops. (Good "dry" gin and the *Spiritus Juniperi Compositus* of the old U. S. P. are virtually identical therapeutically.) When diuresis is required, and atony of the kidneys is present, without inflammation, gin is a useful medicament, provided that alcohol is indicated. Gin is one of the alcoholic drinks most apt to produce cirrhosis of the liver if taken in excess.

Port Wine (*Vinum Portense*) is a fermented wine, to which pure spirit is added to increase its strength. It is one of the strongest table wines, and is useful as a supportant in convalescence.

Sherry (*Vinum Xericum*) has about 30 per cent of alcohol in it.

Beer is made by a slow fermentation, while ale is made by a more rapid fermentation at a higher heat. Most of the beer in America contained about 4 to 6 per cent of alcohol before prohibition laws were passed.

Porter resembles the other malt liquors closely, except that it contains more solids, due to a scorching of the grain by a high heat.

The B. P. preparations that are not official in the U. S. P. are rectified spirit (*Spiritus Rectificatus*) and sherry (*Vinum Xericum*). *Mistura Spiritus Vini Gallici* is a useful, pleasant and nutritious stimulant made by beating up the yolks of 2 eggs with ½ ounce of sugar, and then adding 4 ounces each of brandy and cinnamon-water. This is sometimes called "egg-flip." Dose 1 to 2 ounces (30.0–60.0).

ALLIUM.

Garlic, or *Allium Sativum*, is a stimulant to digestion, owing to the volatile oil it contains, which by its somewhat irritating properties excites the gastric mucous membrane to increased secretion. In *persistent colds*, where the bronchial tubes are particularly affected, a garlic poultice made by pounding the bulbs in a mortar, is a very efficient though disagreeable remedy. If the skin is too delicate to permit of the use of pounded garlic alone, it may be mixed with equal parts of bran, and a poultice or plaster made thereof. Employed in this form, allium is useful if applied over the spine or feet in the treatment of the *cerebral* and *spinal convulsions* of infants; placed over the belly in cases of *gastro-intestinal catarrh*, it acts almost as well as a spice poultice. In the treatment of children with *chronic colds* garlic may be used boiled in milk, and the liquid given as a drink, warm or cold; or the oil of garlic may be given in emulsion in the dose of 1 or 2 minims (0.05–0.1). It ought not to be given during the febrile stage, as it is stimulating. Allium juice has also been used in the dose of 2 to 5 drops (0.1–0.3) to relieve *nervous vomiting*. The dose of the syrup (*Syrupus Alii*) for a child is 1 dram (4.0), but 4 drams (16.0) may be given to an adult.

ALLONAL.

Allonal is closely related to dial, barbital and luminal, all of which contain barbituric acid, but this drug contains dial and amidopyrin in the proportion of about 1 to 2 and possesses the sedative effect of both of its ingredients and the pain-relieving properties of amidopyrin. Chemically it is allyl-isoprophyl-barbituric acid + phenyl-di-methyl pyrazolon.

In cases of *nervous insomnia* it finds its chief usefulness, especially if there is present neuralgic or other pain originating in the nervous system. Like all the other barbituric acid compounds, I have found it disadvantageous in the insomnia of uremics and in the acute infectious fevers, as it produces definite mental torpor after its primary effects are past if taken too late at night. It should not be given to febrile patients because the amidopyrin acts as an antipyretic and renders the temperature chart useless. As placed on the market it appears in tablets of 0.16 equal to 2⅔ grains, of which 1 grain is allyl-propyl-barbituric acid and $1\frac{2}{3}$ grains amidopyrin. The dose is 1 to 4 tablets. In such doses it is said to be devoid of any depressant effect on the circulation or respiration. (See Dial.)

ALMONDS.

Almonds occur in the form of the sweet almond (*Amygdala Dulcis*, B. P.). Bitter almonds develop hydrocyanic acid in the presence of water by the reaction between the amygdalin and water in the presence of the emulsin contained in them; this is not the case with sweet almonds.

Sweet almonds, when rubbed up in a mortar with water, form a pleasant-tasting emulsion of an agreeable odor that is very useful as a vehicle for remedies having a disagreeable taste. Almond bread has been proposed as a food for diabetics, owing to its containing virtually no starch; but it is requisite that the oils and saccharine constituents of the almond shall first be removed. (See Foods for the Sick.)

When $\frac{1}{2}$ ounce of sweet almonds are rubbed up with 30 grains of gum arabic and 2 drams of sugar, to which is added gradually $\frac{1}{2}$ pint of distilled water, the mixture being then strained, an emollient and soothing drink is formed, which is very useful in *irritations of the stomach* and *intestines* and of the *air passages* and *pharynx*. The expressed or fixed oil of almonds is a useful demulcent, and has been recommended in the *cough of phthisis*, given in the dose of a $\frac{1}{2}$ dram (2.0) in emulsion.

Bitter almonds yield an oil (*Oleum Amygdalæ Amaræ*, U. S.) which is exceedingly poisonous owing to the prussic acid which it contains, and it is said that 1 drop will kill a cat, while 17 drops have killed a man. Oil of bitter almond should contain from 2 to 4 per cent of hydrocyanic acid.

Bitter almonds have been used to allay irritable coughs and similar states, but are not frequently employed because other drugs are less dangerous, more stable, and more active as remedial agents. The emulsion of bitter almonds is made as is that of sweet almonds, and may be used in teaspoonful doses for the same purposes and as a vehicle in cough mixtures. Both emulsions are useful as vehicles in the treatment of *gonorrhea*, as they diminish the burning on urination. Almond emulsions, when locally applied, are supposed to be of value for the removal of *freckles* and *sunburn*.

The preparations of sweet almonds are: an emulsion (*Emulsum Amygdalæ* and *Mistura Amygdala*, B. P.), dose 1 to 2 ounces (30.0-60.0); a compound powder (*Pulvis Amygdalæ Compositus*, B. P.), given in the dose of 1 to 2 drams (4.0–8.0); and the oil (*Oleum Amygdalæ Expressum*, U. S., and *Oleum Amygdalæ*, B. P.), the dose of which is 1 to 4 drams (4.0–16.0). *Aquæ Amygdalæ Amaræ* is prepared from the oil of bitter almonds. The dose is 60 to 120 minims (4.0–8.0).

ALOES.

Aloes, or *Aloe,* of the U. S. P., contains an active principle known as aloin (*Aloinum,* U. S. and B. P.), which is a crystalline substance. As generally sold, aloin is, however, an amorphous powder of extremely bitter taste.

Physiological Action.—Locally applied to the tongue, aloes is a bitter of rather a persistent taste. According to the studies of Rutherford, the drug increases very considerably the flow of bile in the dog, but in man it cannot in any sense be regarded as a medicament for the production of an increased biliary flow. Rutherford's doses given to the dog amounted to as much as 60 grains, equal to 3 or 4 drams in a man. In the lower animals and in man aloes acts very slowly, requiring several hours for its influence to be manifested unless the dose be toxic in amount. Its chief influence is on the lower bowel (Fig. 6), although Pfaff and Nelson assert that it also acts upon the stomach and upper bowel. As much as 4 drams of aloes have been injected into the veins of a horse without inducing purgation, probably because 4 drams were not enough to affect the bowels of this animal. It is eliminated in the milk of nursing women, and will cause purgation in an infant put to the breast of a patient taking it. If the doses be quite large (10 to 20 grains), the passages will be water; but if the dose be more moderate (2 or 3 grains), the stools will be thick and pultaceous.

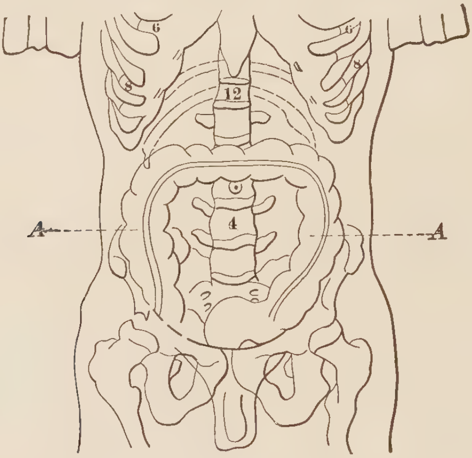

Fig. 6.—*A*, chief effect of aloes is exercised in lower bowel or colon.

Therapeutics.—Aloes should be used only when a somewhat slow stimulant to peristaltic movement is desired, and never where the object of the physician is to relieve congestions by depletion through the intestine. It is a favorite remedy in cases of subacute or chronic constipation, but it is distinctly harmful if continued for any length of time, as it seems to produce atony of the bowel. Owing to its bitter properties it acts as a tonic to the stomach, and is often given with iron, as clinical experience indicates that their conjoint use is beneficial. Its good effects depend upon its preventing the constipation which might be produced by the chalybeate.

When taken in a sufficiently large dose to produce a copious passage, aloes nearly always produces a feeling of weight and fulness in the region of the rectum after the evacuation, and the writer has seen severe rectal catarrh produced in this way in very susceptible persons. If given alone, it is very apt to produce griping, and it ought always to be combined with other drugs whose tendency is to prevent intestinal spasm.

In cases of *hemorrhoids* in individuals suffering from general muscular relaxation and atony, aloes is said to do great good, but its use under these circumstances is by no means universal or generally accepted as correct. For weak, anemic persons leading sedentary lives it may be combined with tonics to relieve the *constipation* so often an urgent symptom in these cases. In *amenorrhea* dependent upon atony of the sexual system, or anemia, or constipation, it is thought to have a specific emmenagogue influence. Locally applied in the form of the glycerol of aloes, it has been employed in the healing of *old* or *recent fissures* of the rectal *mucous membrane*, and even of *bed-sores*. The glycerole of aloes is to be made by evaporating 4 to 8 parts of tincture of aloes and gradually adding 30 parts of glycerin.

Contraindications.—Constipation occurring in plethoric persons should not be treated by aloes as they need salines, and it should not be used if any irritation or catarrh of the intestine is present. Pregnant women should use aloes most carefully lest abortion be produced, and if hepatic congestion or inflammation is present it ought not to be used. Fever is also said to contraindicate the use of aloes, as does also rectal catarrh.

Administration.—*Aloes*, U. S., is generally given in a pill, combined with strychnine and belladonna. (See Constipation, Part IV.) The dose should be 1 to 5 grains (0.06–0.3) as a laxative, and 10 grains (0.6) as a purge. The official preparation most commonly employed is the pill of aloes (*Pilulæ Aloes*, U. S. and B. P.), 2 grains (0.12) each of aloes and soap. The dose is 1 or 2 pills. *Aloinum* (U. S.) is given in the dose of $\frac{1}{4}$ grain (0.015). The liquid preparation is the tincture (*Tinctura Aloes*, N. F. and B. P.), dose, 1 to 2 fluidrams (4.0–8.0). The official pills of the B. P. are the *Pilula Aloes et Asafetidæ*, *Pilula Aloes et Myrrhæ*, and *Pilula Aloes et Ferri*. The other B. P. preparation, besides those given, is the *Decoctum Aloes Compositum*, dose, $\frac{1}{2}$ to 2 ounces (15.0–60.0).

ALUM.

Alum (*Alumen*, U. S., and *Alumen Purificatum*, B. P.) is the sulphate of aluminum and potassium in the U. S. P., but in the B. P.

both it and the sulphate of aluminum and ammonium crystallized from a watery solution are official. At present much of the alum of commerce is obtained as a by-product in the manufacture of coal-gas for illuminating purposes, and it is therefore very cheap. It occurs in the form of octahedral crystals, and has an astringent taste and acid reaction. After the crystals are exposed to the air for some time they become covered with a white coating.

Physiological Action.—When alum is brought in contact with a mucous membrane it produces whitening, constriction and puckering of the part, and applied to the skin thickens and hardens it by means of its astringent action. In either case it decreases secretion and causes contraction of the local bloodvessels and capillaries. Large amounts given internally for any length of time seem to increase secretion.

Poisoning.—Very large amounts are necessary to produce death. As much as 2 ounces will not kill a sickly dog. This is largely due to the fact that the vomiting and purging rid the animal of the drug, for if vomiting is prevented death rapidly ensues from gastro-enteritis. Injected into the blood, alum produces embolism and thrombosis.

Therapeutics.—Alum is used at present in a number of diseases, chiefly as a local application. In cases of ordinary *sore-throat* applications of a strong solution (20 grains to the ounce of water—1.3-30.0) on a swab are very useful. It would be of much service in this condition as a gargle were it not that it possesses a destructive action on the teeth. In *hemorrhage,* when the leaking bloodvessels can be directly reached, alum is a powerful hemostatic, aiding in the arrest of the bleeding in three ways—namely, by coagulating the albumin, by constringing the parts, and by crystallizing when applied in large amounts on lint, and thereby affording a surface which is rough and aids coagulation. In hemorrhage after tooth-extraction its application is a very useful treatment. Dissolved in water or alcohol, 2 grains to the ounce (0.1–30.0), it makes an exceedingly efficient application for sponging in *night-sweats* or *localized sweating* of the feet or hands. Used in weak solution in an atomizer it may be resorted to in *bronchorrhea* or *chronic bronchitis* with excessive secretion, and in *chronic catarrh of the pharynx.* In *mercurial ptyalism* a solution of the drug may be used on a swab. Bathing with an alum solution the parts affected is said to be an efficient remedy in *chilblains,* and for *pruritus vulvæ.* As a vaginal wash for profuse *leucorrhea,* in the strength of from 10 to 20 grains to the ounce (0.65–1.3 to 30.0) of water, alum is of value. Some observers claim good results from its use in *diphtheria* and *tonsillitis.* In *follicular tonsillitis* the alum-stick may be deeply inserted into the depressed follicles or applied to the swollen surface of the gland. In *ingrowing toe-nail* with granulations a piece of twisted absorbent cotton soaked in strong alum solution and inserted under the edge of the nail in most instances produces a cure. A popular solution in the dressing of contused wounds called "Alum-Acetate Solution" is composed of:

℞—Alumini	ʒss (2.0)
Plumbi acetatis	ʒj (4.0)
Aquæ destillatæ	f℥iv (120.0)

Dried alum (*Alumen Exsiccatum,* U. S. and B. P.) is useful as a dressing for *old ulcers* and *sores,* and has been highly recommended as an application for *swollen gums* where they press upon and override a tooth, particularly at the back of the jaw. The possibility of its exercising an evil effect on the teeth should not be forgotten.

In the proportion of 1 tablespoonful (15.0) of powdered alum to 1 quart (1 liter) of warm water this drug is often efficient when used as a rectal injection in *postoperative tympanites* and similar states.

Alum may be used as an antidote in *acute lead poisoning,* as it is a soluble sulphate and also an emetic.

The emetic dose of powdered alum is a heaping teaspoonful for a child or a tablespoonful for an adult.

Glycerinum Aluminis (1 to 6) is official in the B. P., and is used as a local astringent application.

ALUMINUM ACETATE.

Aluminum acetate (*Alumini Acetas*) is a useful astringent application in *erysipelas, rhus poisoning, boils* and *carbuncles* in their formative stage, and *septic infections* of the hand and arm or foot and leg. The solution employed is the Liquor Alumini Acetatis of the National Formulary diluted in the porportion of 1 to 7.

ALYPIN.

Alypin is used as a local anesthetic and appears in the form of a white crystalline powder, readily soluble in water and in alcohol, the solution being neutral in reaction. It is a glycerine derivative, technically called the monohydrochloride of benzoyl. Solutions of it can be sterilized by boiling, provided the heating does not extend beyond five minutes. It is claimed to be equal in power to cocaine for the production of anesthesia, and is commonly employed in freshly prepared 2 per cent solution in the eye and in 4 per cent solution on other parts. When dropped into the eye it is said not to cause mydriasis nor affect accommodation. It does not constrict local bloodvessels, which is advantageous in some cases and disadvantageous in others; thus, in operations upon engorged nasal mucous membranes it fails to open the field of operation. The secondary congestion so characteristic of cocaine is said to occur in an exaggerated form after the anesthetic effect of alypin. Solutions of alypin, with or without adrenalin, may be employed for infiltration anesthesia by Schleich's method. Alypin is less irritating than eucaine when dropped in the eye. (See Cocaine.) Alypin has been much used by genito-urinary surgeons in the urethra, but when any solution of continuity exists in the urethra it is prone to cause disagreeable symptoms and in more than one instance has caused convulsions and even death.

AMBER.

Succinum is derived from a fossil resin found in Prussia and in Bohemia, and is used in the form of the oil (*Oleum Succini*), which is volatile, quite irritant, and obtained by destructive distillation from the deposit named.

Therapeutics.—Oil of Amber is one of the best remedies for *persistent hiccough* that we have. It is very useful as a counterirritant over *rheumatic joints*, and has been used in *asthma, whooping cough,* and *hysteria* with good results. In the *bronchitis of infants,* with nervous disturbance, oil of amber in the proportion of 1 to 3 parts of olive oil applied to the back and front of the chest is of service. In adults suffering from *acute laryngitis* with extension of the inflammation into the bronchial tubes, full doses of sodium bromide given internally, with this proportion of amber oil and olive oil rubbed into the neck and chest, are useful. The dose internally is 2 to 6 minims (0.1–0.4) given in emulsion.

AMIDOPYRIN.

Amidopyrina, U. S., trade name pyramidon, dimethyl-amino-antipyrin, is a white powder freely soluble in water with a physiological action practically identical with antipyrin (which see). It is thought by some to be more efficient as a pain reliever than the latter drug. The dose is also identical, namely 5 to 15 grains (0.3–1.0). It is usually given in tablet or capsule but may be administered in solution. It has been claimed that amidopyrin is the equal of sodium salicylate in acute and chronic rheumatism if given freely, but this is doubtful and it may cause a fall in blood-pressure.

Combined with one the newer sleep-producing agents it is sold under the trade names of cibalgine when made up with dial or diallyl-barbituric acid, allonal when mixed with allyl-isopropyl-barbituric acid, and peralga in which phenobarbital is the sedative factor.

AMMONIA (NH_3).

Ammonia is a gas of a very acrid, burning taste, capable of producing death very rapidly when inhaled, by reason of the inflammation of the air-passages and the spasm of the glottis which ensue. It is made in large amounts in the manufacture of coal-gas.

Physiological Action.—When ammonia comes in contact with the tissues of the body it acts as a most powerful irritant, causing a reddening of the parts, followed, if the exposure be sufficiently prolonged, by local death and sloughing. If it be inhaled as a gas, it may produce rapid death by spasm or edema of the glottis, and if a strong solution of it is swallowed, the same accident may occur. Following more moderate inhalations severe bronchitis or pulmonary edema may develop.

Nervous System.—The drug in moderate amounts acts as a spinal excitant, increasing reflex action and all the evidences of spinal activity.

Circulation.—Upon the circulation ammonia acts as a powerful but fleeting stimulant, increasing the pulse-rate, pulse-force, and arterial pressure. The cause of the increased pulse-rate depends upon stimulation of the accelerator nerves of the heart and of the heart itself, while the increase in force is due to the same cause, for Ringer and Sainsbury found the strength of the ventricles much increased. The rise of arterial pressure is due to the increased amount of blood pumped into the arteries by the stimulated heart, and probably by a stimulant action on the vasomotor center, although this is denied by some authorities. As the drug acts as a stimulant on the respiratory center, which is very near the vasomotor center, it probably increases the functional activity of both. If by means of intravenous injection the ammonia reaches the heart in large amount in concentrated form, this organ ceases to beat at once, owing to paralysis of its muscular walls.

Respiration. Inhaled in small amounts or swallowed, ammonia acts as a respiratory stimulant.

Elimination.—Ammonia when taken into the body is so extremely fleeting in its action that the question as to its escape from the system is of interest. If large amounts are taken, it is partly given off by the breath, but more of it is destroyed in the system, and according to Bence Jones, eliminated as nitric acid by reason of its being oxidized in the body. The greater part, however, is excreted as urea.

Therapeutics.—Ammonia is employed for four distinct purposes in medicine—namely, as a circulatory and respiratory stimulant, as a counterirritant, and as an antacid.

The indications for the use of ammonia in the first class of cases are all forms of sudden cardiac failure where there is no time or opportunity to use the more stable and slowly acting drugs. These emergencies occur in *snake poisoning*, in *syncope* from fright or other shock, or from indigestion, in *sudden cardiac failure* during the course of fevers and in pneumonia, and in all cases where prompt cardiac stimulation is needed. In the most pressing cases it should be injected directly into a vein of the leg, so as to act more quickly. If

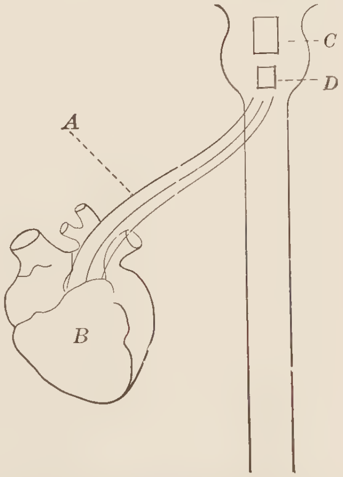

Fig. 7.—Ammonia stimulates: *A*, the accelerator nerves; *B*, the heart-muscle itself, and so quickens pulse-rate and force. It stimulates the vasomotor center *C* and the respiratory center *D*.

put into the subcutaneous tissues, it is almost certain to cause a slough, and if injected into a vein of the arm, it may reach the heart in too concentrated form and cause cardiac depression. Ringer has found that the drug has the extraordinary power of causing a heart stopped or depressed by chloroform to resume its beating. It is claimed, without much justification, that ammonia will aid in preventing *heart-clot* or thrombosis in cases of severe hemorrhage and in pneumonia.

In prolonged diseases the employment of ammonia is not particularly advisable, owing to its fugacious action, although it is largely used, for the frequent administration necessarily required is apt to produce gastric disorder. Some writers claim that ammonia is useful as a sedative in *drunkenness,* but this is doubtful.

In *gastric acidity* due to fermentation, with the development of abnormal acids, ammonia is the most active remedy we can employ, but it is not to be given if acute irritation of the stomach exists.

Locally applied, strong ammonia water may be used to produce a blister by placing a few drops on the skin under an inverted watch-glass. Ammonia water may also be applied, often with great relief, to the *spots stung by insects.* The waters of ammonia are used externally in stimulating liniments, and hypodermically when the drug is so given. The stronger water ought not to be employed for the latter purpose. The aromatic spirit is generally used internally in the dose of ½ dram to 1 dram (2.0–4.0), well diluted. This is also the dose of the ordinary spirit.

Administration.—Ammonia is never employed in medicine as pure ammonia gas, but in the form of the stronger water (*Aqua Ammoniæ Fortior*, U. S., *Liquor Ammoniæ Fortis,* B. P.), containing not less than 27 per cent nor more than 29 per cent (32.5 per cent, B. P.), by weight of the gas, and the weaker water (*Aqua Ammoniæ,* U. S., *Liquor Ammoniæ,* B. P.), which should contain not less than 9.5 per cent nor more than 10.5 per cent by weight of the gas. The aromatic spirit of ammonia (*Spiritus Ammoniæ Aromaticus,* U. S. and B. P.) is given in the dose of 30 to 60 minims (2.0–4.0) in water. The latter preparation is composed of carbonate of ammonium, the oils of nutmeg, lemon, and lavender, with alcohol and ammonia water. *Spiritus Ammoniæ Fœtidus* (B. P.) contains asafœtida, and is used in place of the aromatic spirit. Ammonia liniment (*Linimentum Ammoniæ,* N. F. and B. P.) is used over tender joints and muscles.

AMMONIUM (NH_4).

The following salts of ammonium are official, and are used for various purposes:

Acetate of Ammonium.

Acetate of Ammonium is used in medicine in the form of the spirit of Mindererus (*Liquor Ammonii Acetatis,* U. S. and B. P.), dose 1 to 2 fluidrams (4.0–8.0), 2 to 6 fluidrams (8.0–24.0), B. P., for the purpose of acting as an antacid in *gastric indigestion*, and also as a mild diuretic and diaphoretic which is inferior to sweet spirit of nitre.

Benzoate of Ammonium.

Benzoate of Ammonium (*Ammonii Benzoas*, U. S. and B. P.) is employed chiefly for its diuretic influence, which depends largely upon the benzoic acid present in the compound. As benzoic acid is eliminated as hippuric acid and ammonia as nitric acid, this drug may be employed in cases where the physician desires to make the urine decidedly acid, as, for example, in patients suffering from *catarrh of the bladder*, when the urine is loaded with phosphates, which are dissolved by this acidulation. It is useful in certain cases of *muscular rheumatism*. The dose is 10 to 30 grains (0.6–2.0), which should be suspended in water or, better, administered in cachets or capsules.

Bromide of Ammonium.

Bromide of Ammonium (*Ammonii Bromidum*, U. S. and B. P.) when applied to the mucous membrane of the mouth produces a salty taste, is markedly pungent and dissolves readily in the oral secretions. If large amounts are swallowed it causes burning pain in the belly and evidences of gastro-enteritis. (See Potassium Bromide.)

Nervous System.—The action of this drug upon this part of the body is its most important effect. In a series of studies undertaken by the writer to determine the effect of the drug it was found that the spinal cord was depressed, both on its motor and sensory sides, while the nerves and muscles escaped. These results are in accord with those of other investigators, who also found that the nerves are unaffected. On the cerebral cortex it acts as a distinct sedative. (See Bromide of Potassium.)

Circulation.—In medicinal dose it is stimulant to the circulation, but not sufficiently so to render it valuable as a circulatory stimulant, to the exclusion of other more powerful preparations.

Therapeutics.—The bromide of ammonium may be used in nearly every instance where bromide of potassium may be employed, and possesses the distinct advantage of being less depressant to the general system than the latter drug. It is, however, more apt to disorder the stomach even if given in moderate doses. In *epilepsy* it would seem to be of as much value as the potassium salt, and may be combined with it in some cases with success. (See article on Epilepsy, Part IV.) According to J. M. DaCosta, the drug is of distinct value in *rheumatism* in the dose of 60 to 80 grains (4.0–5.3) a day, well diluted with water, although its manner of action in this disease is not known. The usual dose is 10 to 30 grains (0.6–2.0). It is incompatible with spirit of nitrous ether.

Ammonium Carbonate.

Ammonium Carbonate (*Ammonii Carbonas,* U. S. and B. P.) undoubtedly has an action exactly like that of the liquid preparation of ammonia, and is used either alone or with the chloride in the treatment of *bronchitis,* particularly when this disease occurs in babies and young children. Ammonium carbonate is also largely employed by surgeons in the treatment of children after a surgical operation to overcome the *respiratory and circulatory depression* produced by the anesthetic. The dose is 2 to 10 grains (0.12–0.6) in syrup of acacia and water. It is a rapidly acting cardiac and respiratory stimulant.

℞—Ammonii carbonatis		gr. xlviij (3.2)
Syrupi acaciæ		f℥ (30.0)
Aquæ destillatæ	q. s. ad	℥iij (90.0).—M.

S.—Teaspoonful (4.0) every two hours in water for a child of three or four years.

Ammonium Chloride.

Ammonium Chloride or Muriate (*Ammonii Chloridum,* U. S. and B. P.) has an entirely different action and therapeutic use from the rest of this group. It possesses almost no influence over the heart and respiration, but does exercise a very stimulant effect on mucous membranes, increasing the secretion of mucus. The consideration of its use in diseases of the lungs can be found in the articles on Pneumonia and Bronchitis. When full doses of ammonium chloride are given to a healthy man there occurs increased respiration, increased flow of urine and decrease in the carbon dioxide carrying power of the blood. If pushed in larger doses the increased respirations become dyspneic, polyuria and thirst are excessive and the man becomes restless. The carbon dioxide carrying power of the blood falls lower than before and a rise in hemoglobin takes place because of profuse loss of water and therefore blood concentration. These facts are to be borne in mind when a patient who is ill is receiving full doses of ammonium chloride as indicated in the following paragraphs as the sick man is not as well equipped to deal with doses which are very large. In other words if full doses are given and the cardio-renal patient becomes dyspneic, the physician must recall the possibility that the drug and not the heart or kidneys are at fault and cut down or stop the dose.

Full doses (1 to 4 drams a day (4.0–16.0) of this salt often induces active diuresis in cases suffering from renal dropsy. Very large doses often as much as ½ ounce (15.0) have to be given once or twice a day to some patients. If severe renal inadequacy is present it is contraindicated. Its effect in relieving dropsy depends in all probability upon the increased elimination of sodium chloride. In other words, the indication for its use is that type of edema due to salt retention. Under its use Keith and Whelan have shown that on entering the blood it is speedily split up into ammonia and chlorine and the ammonia rapidly forms urea so that the amount of urea in the blood and in the urine is increased. If there is evidence of acidosis in nephritis it is contraindicated and if symptoms of this state develop it should be stopped and sodium bicarbonate be freely given. If dyspnea is present it is also contraindicated as the impaired respiration aids in inducing the acidosis.

As ammonium chloride in full doses definitely increases the acidity of the urine and as an acid state is destructive to Bacillus coli, this drug may be used with advantage in *pyelitis* due to the colon bacillus.

Excellent results have followed the free use of this salt in the treatment of *tetany*. It is supposed to act by overcoming the so-called alkalosis present in this state. In the treatment of *chronic torpor of the liver* and *subacute hepatitis*, and in *cirrhosis* its value depends on its influence on the associated catarrh of the bile passages. Many clinicians have found it useful in the treatment of the *gastric* and *intestinal catarrhs* of children of a very subacute type, and it is the routine treatment for all such cases which come under observation at the hospital and elsewhere where the author has charge. The dose is 5 to 15 grains (0.3–1.0) for such patients, preferably given with liquorice and water to mask the taste.

℞—Ammonii chloridi		ʒij (8.0)
Fluidextracti glycyrrhizæ		f℥j (30.0)
Aquæ destillatæ	q. s. ad	f℥iij (90.0).—M.

S.—Teaspoonful (4.0) t. i. d. in water after meals for a child of five or ten years.

The chloride of ammonium may, however, be given in compressed tablets to adults, provided a large draught of water or milk is taken simultaneously to protect the stomach. (See article on Bronchitis for other prescriptions.)

Ten grains (0.06) of chloride of ammonium given one-half hour before meals often gives extraordinary relief in *painful dyspepsia* due to hyperacidity of the stomach.

Chloride of ammonium, in a lotion of the strength of 1 ounce (30.0) to 3 quarts (3 liters) of water, is an efficient remedy for the *dermatitis* caused by poison-ivy.

Ammonium Valerate.

Ammonium Valerate (*Ammonii Valeras*, N. F.) is the salt of ammonium commonly used in the *nervous unrest* of pregnant or hysterical women, or at the *menopause* in the peculiar nervous disorders apt to occur at that period. In poisonous doses it paralyzes the spinal cord in the lower animals. It is usually given in the form of elixir of valerate of ammonium, the dose of which is a teaspoonful to a dessertspoonful, or it is combined with the bromides, under which circumstances it is much more efficacious. The dose of the salt itself is 10 to 15 grains (0.6–1.0).

The B. P. preparations besides those already given are: *Phosphate of Ammonium*, dose 5 to 20 grains (0.3–1.2), and *Liquor Ammonii Citratis*, dose 2 to 6 fluidrams (8.0–24.0).

AMYL NITRITE.

Amyl Nitrite (*Amylis Nitris*, U. S., *Amyl Nitris*, B. P.) is not to be confounded with *nitrate* of amyl, which has a different physiological action and is never used medicinally.

Physiological Action.—When swallowed or inhaled, the drug produces staggering, fulness in the head, roaring in the ears, duskiness of the face, and finally complete muscular relaxation, so that the animal or man falls to the ground. The heart beats very rapidly and forcibly, and the respiration becomes gasping.

Nervous System.—Nitrite of amyl is the most rapidly acting of all the nervous depressants and sedatives which are used as medicines, except prussic acid. Experiments show that its dominant action is on the motor side of the spinal cord. The motor cortex of the brain and the motor nerves are only affected by large amounts. Upon the nervous apparatus of sensation nitrite of amyl has no effect in medicinal amounts, and should never be used to relieve pain unless it be due to spasm or to angina pectoris. The muscles are depressed by toxic amounts.

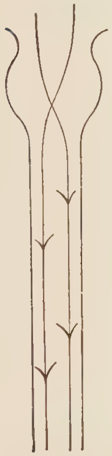

Fig. 8.—Nitrite of amyl depresses the motor or crossed pyramidal tracts of the spinal cord.

Circulation.—When nitrite of amyl is used, the pulse becomes exceedingly rapid while the arterial tension speedily falls. The increase in pulse-rate is due to depression of the centric inhibitory apparatus (vagus centers) of the heart and to the sudden relaxation of the bloodvessels, by reason of which, the resistance being taken away, the heart beats faster. The fall of arterial pressure is chiefly due to depression of the muscular coats of the bloodvessels and also to slight depression of the vasomotor centers, but the bloodvessels of the pulmonary system are constricted by the nitrites. In very small amounts the drug stimulates the heart-muscle (Reichert), but its dominant action on the heart is that of a depressant.

The Blood.—In large medicinal dose this drug produces a chocolate color of the arterial blood, due to the change of oxyhemoglobin into methemoglobin.

Urine and Elimination.—The urine sometimes contains sugar after the use of nitrite of amyl, and there is increased diuresis. The drug is eliminated very rapidly from the body by the lungs and kidneys.

TEMPERATURE.—If the nitrite of amyl be employed for any length of time, a most remarkable fall in bodily temperature ensues, which is probably due to diminished oxidation, but possibly to some effect on the heat centers governing heat production and dissipation. The vascular dilatation also tends to aid greatly in the loss of bodily heat produced by the drug.

Therapeutics.—Nitrite of amyl is used to *relax general* or *local muscular spasms,* for the relaxation of the spasm of *epilepsy* and for *aborting an on-coming fit,* for the prevention and subjugation of *strychnine convulsions* and *tetanus,* and for the relief of *angina pectoris,* provided the attack is accompanied by high arterial tension. It may be used in *puerperal eclampsia,* but it is a dangerous remedy because of its relaxation of the uterus and the consequent danger of postpartum hemorrhage. Nitrite of amyl by inhalation is the best remedy to check *hemoptysis*, because it constricts the pulmonary vessels and simultaneously relaxes the systemic circulation, thereby diminishing the flow of blood to the lungs. In *dysmenorrhea* with uterine spasm it often gives great relief but nitroglycerin is better. Nitrite of amyl has been used in cases of *seasickness* as a prophylactic and cure with considerable success, but its action is so severe and so fleeting, and its depressant effect on blood-pressure so strong that I would never employ it. In *cardiac failure* from fright or anesthetics amyl nitrite is of some value when given in single whiffs. If it does not act favorably in restoring cardiac action at once, it is worse than useless to push it. It has also been found of value in *whooping cough, laryngismus stridulus, asthma, spasmodic croup,* and *infantile convulsions.* In *migraine,* with local vasomotor spasm and true hemicrania, it is very useful. In *strychnine poisoning* and *tetanus* it must be inhaled between the spasms or else given hypodermically, as the respiratory cramp prevents its inhalation.

Administration.—The drug may be given by placing 3 to 5 drops on a handkerchief and inhaling the fumes, or it may be dropped on sugar and taken by the mouth in the same quantity. The best way for patients to use the drug is to have it in hollow pearls of glass, each holding 5 or 10 minims (0.3-0.06). One or more of these may be crushed in a handkerchief and the fumes inhaled.

It is important to remember the fact that the effects of the drug are more severe for a moment after its use than during its inhalation. The physician should warn the patient that the effect of the drug is sudden and alarming, and in nervous cases should direct that the inhalations be made slowly, as a very full inhalation may produce unpleasant sensations of cardiac oppression.

AMYTAL.

Amytal is used for the same purposes as is dial and barbital (which see). It is iso-amyl-ethyl-barbituric acid and the dose is usually $1\frac{1}{2}$ grains (0.1) but twice this amount is often given.

ANTIMONY.

Antimony itself is rarely used in medicine, owing to its insolubility, but is generally employed as the tartrate of antimony and potassium, or Tartar Emetic (*Antimonii et Potassii Tartras,* U. S.; *Antimonium Tartratum,* B. P.).

Owing to its chemical constitution tartar emetic should never be given with either acids or alkalies, and all drugs containing tannic acid are also incompatible with it, owing to the fact that an insoluble tannate is rapidly formed, which is absorbed very slowly if at all. So complete is the insolubility of the compound so formed that tannic acid is the best chemical antidote to the drug that we possess.

Physiological Action.—Tartar emetic, when applied to mucous membranes, produces a burning sensation, and upon the skin it may readily cause intense irritation if the part be delicate. If kept in contact with a mucous membrane, very distinct inflammatory changes occur, and if it be applied to the skin for any length of time, redness, followed by acne of a pustular character, appears, which finally ends in ulceration and sloughing if the use of the drug is persisted in. Under these circumstances the vitality of the parts seems interfered with, and, as a result, healing takes place very slowly indeed.

NERVOUS SYSTEM.—Antimony is a depressant to the sensory side of the spinal cord, and a paralyzant to all the spinal centers, motor and sensory, in poisonous dose.

CIRCULATION.—The chief influence of antimony is exerted upon the circulation. In small doses it lowers the pulse-rate by a direct depression of the heart-muscle, and simultaneously decreases arterial tension by an action upon the peripheral portions of the vasomotor system in the walls of the bloodvessels, but the vasomotor influences may be in part centric, and this question must be considered as *sub judice.* The fall of arterial pressure is also due to failure of heart-force. With the lowering of the pulse-rate there is nearly always a corresponding decrease in cardiac power.

When poisonous doses are employed, death ensues after great circulatory and respiratory depression, as will be seen below. The heart is found after death relaxed and flabby and wholly unresponsive to all stimuli, although in one of the lower animals, such as the frog, if the dose has not been very excessive and digitalis is freely employed, the heart may be made to beat again. In man, it is hardly necessary to state, the digitalis must be used early to render much service. The drug in poisonous doses is thought to depress the peripheral ends of the vagus nerves.

RESPIRATION.—The drug has little or no effect upon respiration except when given in lethal doses. Under these circumstances death is produced in three ways, all of them acting together. Primarily, the respiratory center in the medulla is depressed, and the governing nerves of breathing, the pneumogastrics, are also rendered inactive;

secondarily, the cardiac failure speedily causes pulmonary congestion; and thirdly, the drug causes such an out-pouring of liquid mucus into the bronchial tubes that the patient is drowned in his own secretions which he is too weak to expel.

Stomach and Intestines.—Antimony in toxic doses is a powerful irritant to these portions of the body. In full medicinal amounts it acts as a slow but powerful emetic, producing much nausea, The vomiting is due to an action on the vomiting center in the medulla transmitted through the afferent fibers of the vagi and not to a direct effect on this center, and to a direct action on the stomach itself. The drug is, therefore, a centric and peripheral emetic. Very full doses produce watery purging, attended with some griping and tenesmus.

Elimination.—Antimony escapes from the body in all the secretions, but largely by the bowels. The latter method of elimination seems chiefly to follow poisonous doses, and purging is an effort at elimination.

Therapeutics.—Tartar emetic is employed for at least five separate purposes, the most usual of which is as a *circulatory quieter* and *sedative*. The indications for antimony as a circulatory depressant are not so generally recognized at present as they were at one time, on account of the introduction of other drugs. All states of *sthenic inflammation* with a bounding pulse, high fever, and symptoms showing the patient to be possessed of robust constitution permit of its use, while all asthenic conditions most emphatically contraindicate its employment. In the treatment of *colds*, to break *forming diseases*, and to allay *inflammation* it is given in moderate dose. It is useful in *sthenic bronchitis* as an expectorant. Under these circumstances it may be given in emetic dose; or, if emesis is not desirable, minute amounts given hourly are of value, such as $\frac{1}{60}$ grain (0.001) every hour, or a teaspoonful of a solution of $\frac{1}{2}$ grain (0.03) to 4 ounces (120 cc.) of water every hour may be used. This has been recommended particularly in children, as the solution is tasteless and it does not produce nausea and vomiting.

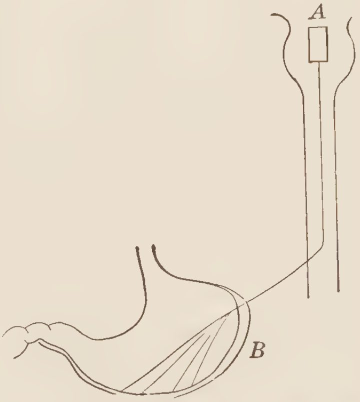

Fig. 9.—*A*, antimony stimulates the vomiting center; *B*, antimony irritates the gastric mucous membrane.

Most modern practitioners have ceased to use this drug as a circulatory sedative because the depressant plan of treatment is out of favor, and because the effects of the vegetable cardiac sedatives are more easily controlled.

As an *emetic* antimony is slow but forcible. It ought not to be used in cases of poisoning by other drugs, owing to its depressant effects and slowness of action.

The intravenous use of tartar emetic is very efficient in curing *chancroid.* The dose used is 3 cc. of a 1 per cent solution in sterile water gradually increased by 1 cc. each dose, the injection being given every fourth or fifth day until 10 cc. are given. A relatively small proportion of patients suffer from coughing, salivation or vomiting, for a brief period, after the injection. If the smaller doses cause much reaction the large ones should not be used. This treatment relieves pain and produces very prompt results.

Tartar emetic is used in the treatment of a number of parasitic invasions as for example *kala azar* and *granuloma inguinale.* It acts promptly in the latter malady in the sense that improvement speedily occurs but persistent treatment is essential. One-tenth of a grain is given intravenously in 10 cc. of sterile salt solution every week. Relapses may occur. The injections are painful and often induce phlebitis so it is customary to begin on the back of the hand and travel up the arm. Sometimes severe joint pains follow the injections.

Tartar emetic is harmful if irritation of the stomach is present or if renal inflammation is present. If one good-sized emetic dose is not sufficient to produce vomiting, it should not be repeated, but some other emetic or the stomach-pump be used, lest antimonial poisoning complicate the case. The emetic dose must be large enough to be effective, or none at all should be given. If this rule is disregarded, systemic changes come on with undesirable severity in those cases where emesis fails to occur because of small doses.

Antimony is an efficient diaphoretic, but its use is undesirable, owing to its disagreeable effects, such as nausea and intestinal disturbance, and because other, more pleasant, drugs act equally well.

Administration.—The dose of tartar emetic when there is an excited circulation is $\frac{1}{20}$ to $\frac{1}{10}$ grain (0.003–0.006) every three hours until an effect is obtained. As an emetic the dose is $\frac{1}{2}$ to 1 grain (0.03–0.06). The compound pill of antimony (*Pilulæ Antimonii Compositæ*, or Plummer's pill), was used as an alterative, and contains sulphurated antimony $\frac{1}{2}$ grain (0.03), calomel $\frac{1}{2}$ grain (0.03), guaiac 1 grain (0.06); the dose is 1 to 3 pills.

The ointment of antimony (*Unguentum Antimonii Tartarati*) is used externally as a counterirritant spread on a rag or piece of lint. Antimonial powder (*Pulvis Antimonialis*, B. P.), or James's powder, contains oxide of antimony and phosphate of calcium, and is given occasionally as an antipyretic in the treatment of *rheumatism* and *fever* in the dose of 3 to 6 grains (0.2–0.4); it is best given in a pill.

The compound syrup of squill (*Syrupus Scillæ Compositus*, U. S.), otherwise known as "Coxe's Hive Syrup," contains $\frac{3}{4}$ grain (0.045) of tartar emetic to the ounce. The dose is 20 to 30 minims (1.3–2.0) for an adult as a sedative, or from this amount to 1 dram (4.0) to a child as an emetic.

Poisoning.—When toxic doses of tartar emetic are taken, the pulse at first becomes slightly weaker and slower, the skin becomes moist and relaxed, a general sense of relaxation comes on, and simultaneously a sensation of severe nausea and gastric distress appears.

Following this condition violent vomiting asserts itself. The ejected mass consists of the contents of the stomach—mucus, bile, and watery fluids, perhaps blood. Purging appears almost as early as the vomiting, and consists first of the normal contents of the intestines, then mucus, then bile, and, very rarely, blood. These signs may rapidly pass away and the characteristic "rice-water stools"[1] of antimonial poisoning appear. The general condition of the patient is now most serious. The face is pinched, livid, and covered with a cold sweat. The pulse is rapid and shuttle-like—to and fro—or lost at the wrist; the arterial tension is almost *nil*. The respirations are faint and fluttering, and so shallow as hardly to be seen or heard. Cramps in the calves of the legs attack the patient, due to the abstraction of water from the tissues by the violent purging, and the temperature falls lower and lower as death approaches. The general condition is such that all the signs point to Asiatic cholera, and antimonial poisoning cannot be distinguished from this disease during an epidemic without a history of the case or a chemical analysis of the secretions, which ought always to be preserved.[2]

The treatment of antimonial poisoning consists in the internal administration of large amounts of tannic acid to form the insoluble tannate of antimony, in the use of the stomach-pump, and in the maintenance of an absolutely dorsal position. When tannic acid cannot be had, ordinary tea leaves may be boiled and the decoction given as an antidote and stimulant. The patient should vomit into towels and not raise the head from the pillow; the head, indeed, should generally be placed lower than the heels. External heat, atropine and digitalis should be used freely, and morphine should be employed hypodermically to allay pain and irritation unless the respirations are too feeble. If the opium is greatly needed because of pain, and yet seems contraindicated because of depression, it should be accompanied by strychnine to stimulate the respiratory center and overcome any depression produced by the opium.

Fatty degeneration of all organs may occur as a result of acute antimonial poisoning.

Chronic poisoning by antimony is quite a rare affection, but it occurs chiefly in type-founders and type-setters. McWalter has reported instances in which peripheral neuritis, disorders of the bladder, and irritability of the prostate developed in these artisans. Headache, abdominal tenderness, and an irritable state of the mucous membranes were also present, associated with profound mental depression and circulatory feebleness. These facts are of interest because it is a superstition among some of the lower classes that the administration of antimony will cure the alcoholic habit, and if given for a long time these symptoms and fatty degeneration might ensue, leading to suspicion of attempted murder by poison.

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[1] A "rice-water stool" is one which, on standing in a glass, separates into two layers, the lower white and flocculent, the upper water and almost clear.

[2] This is a good opportunity to state that the secretions and excretions of a person dying of any poison should be placed in a chemically-clean jar capable of being sealed. The same rule of cleanliness applies to the jars holding organs at the postmortem. The jars should be at hand, and no intermediate vessel used. They should be sealed at once, and kept so until claimed by the authorities.

ANTIPYRINE.

Antipyrine (*Antipyrina*, U. S.; *Phenazonum*, B. P.) is a derivative of coal-tar, its chemical name being phenyldimethylpyrazolon It was discovered by Ludwig Knorr in 1884, and introduced into medicine by Filehne. Antipyrine is a white powder of a somewhat bitter taste, and is very soluble in water, less so in ether, alcohol, and chloroform.

When antipyrine is given to a man in full medicinal amount, it causes a sensation of buzzing and tightness of the head not unlike that produced by quinine. The bodily temperature, if normal, is depressed a fraction of a degree, but no other symptoms are manifested. If the dose be quite large, some blueness of the lips and finger nails appears, chilly sensations are experienced, and finally a profuse sweat breaks out over the entire body, which is more severe if fever has previously existed. Large doses sometimes cause nausea and vomiting.

Physiological Action.—NERVOUS SYSTEM.—When a large poisonous dose of antipyrine is given to one of the lower animals, relaxation, complete loss of reflex action, and total inability to move come on at once, and death ensues. Somewhat smaller doses produce exceedingly severe tetanic and epileptiform convulsions, but consciousness seems to be preserved. It has been proved that the chief cause of the convulsion is an action of the drug on the brain.[1] Very large toxic doses, therefore, decrease reflex action, and smaller ones increase it, though medicinal amounts certainly lessen reflex activity to a notable degree. The cause of this failure of reflexes is depression of the sensory nerves and the receptive centers of the spinal cord. Medicinal amounts must, therefore, be regarded as very distinct nervous sedatives, acting much more actively on the nerves of sensation than on those of motion. Injected beneath the skin or applied to a mucous membrane, antipyrine is a powerful local anesthetic, the anesthesia lasting often for several days.

CIRCULATION.—The studies of a very large number of pharmacologists prove most conclusively that antipyrine in moderate doses has no effect on the circulation of the lower animals unless these be so frequently repeated that cumulative effects ensue. Many reliable clinical observers have asserted that the drug depresses the circulation in man in some cases, and antipyrine is certainly not a cardiac stimulant. The writer is confident, however, that antipyrine is not so distinctly a cardiac depressant as some believe. On the other hand, there can be no doubt that in some persons it tends to lower arterial tension and so to produce syncope. It must therefore be used with caution in patients who have a feeble circulation. Large, poisonous doses lower blood-pressure unless convulsions are present, when the pressure is raised. In many of the cases where vascular depression and collapse have followed its use it has been employed in excessive amounts or the fall in bodily temperature has caused the untoward symptoms. (See Fever and its Treatment.)

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[1] See author's Boylston Prize Essay of Harvard University, on Antipyretics.

BLOOD.—No spectroscopic changes in the blood follow the use of medicinal doses of antipyrine in the ordinary individual, but in poisonous amounts it produces methemoglobin. If the doses be toxic or idiosyncrasy exists, cyanosis may come on. That the blood is not destroyed by small amounts is proved by the absence of hematin in the urine of persons taking the drug. The corpuscles suffer no changes except in very pronounced poisoning, when they are said to become crenated and shrivelled.

RESPIRATION.—When antipyrine is given in lethal doses, death results from failure of the respiratory center. Ordinary doses have no effect on this function, but large ones make the breathing more rapid.

TEMPERATURE.—In normal men and animals antipyrine in medicinal dose may be considered as without effect so far as bodily temperature is concerned. In fevered animals it has been found to lower temperature by decreasing heat production and increasing heat dissipation. That it does not do this by an action on the blood seems proved by the fact that the blood is not affected by medicinal amounts. The sweating does not cause the fall since it takes place when no sweating occurs. It may, therefore, be considered that the drug directly affects the nervous heat-mechanism of the body.

KIDNEYS, TISSUE-WASTE, AND URINE.—A large number of studies made upon man and the lower animals by competent investigators have brought about very considerable advances in our knowledge of the influence of antipyrine upon tissue-waste. It is useless to burden this volume with a discussion of their methods and results, which may be found in the author's *Essay on Antipyretics*. Suffice it to say that, while all observers are not agreed as to the effects produced, the deductions apparently to be drawn are that the drug diminishes the quantity of the urine excreted, and also decreases the elimination of the results of nitrogenous tissue-metamorphosis—or, in other words, is a conservator of the tissues of the body.

ELIMINATION.—The elimination of antipyrine goes on very rapidly indeed, and begins almost at once after its ingestion. Maragliano and Reihlen state that it appears in the urine in three hours after it is taken, so that at the fourth hour elimination is at its height, although it continues to be eliminated for twenty-four or perhaps thirty-six hours. According to Pavlinow, part of the antipyrine ingested is eliminated by the salivary glands.

Poisoning.—The treatment of poisoning by antipyrine consists in the administration of stimulants, the maintenance of bodily heat, the use of atropine to restore the tone of the vascular system, and, if cyanosis is alarming, the employment of oxygen inhalations.

Antiseptic Power.—Antipyrine exerts a very distinct antiseptic action in small amounts, delays all forms of fermentation, and destroys germs when it is present in large quantity.

Therapeutics.—Antipyrine is employed in medicine for two great purposes—namely, for the reduction of *fever* and the relief of *pain*—but its employment as an antipyretic is now far surpassed by its use as an analgesic.

As an antipyretic, antipyrine should be given in a few full doses rather than frequent small ones, as a general rule, since if the fever is of any severity the latter method of administering it will have no antipyretic effect, and the constant dosing will produce a gradual saturation of the system without causing a fall of temperature. On the other hand, too large doses may depress the temperature to a point below normal and induce collapse. In the article on Fevers (Part IV) the conditions are indicated in which the drug is best employed, these being the sthenic fevers as a rule, or instances where excessive outbursts of fever necessitate prompt reduction of temperature. In excessively *high temperature in pneumonia* it has been used, and in *scarlet fever* and *smallpox* antipyrine is occasionally of service, although in *pneumonia,* as a rule, the condition of the patient indicates the use of cold to the chest as a local measure for the reduction of congestion or the use of cold sponging to relieve fever. (See Pneumonia.) *The use of the cold applications is always to be preferred to antipyrine in the reduction of fever, since they are safer, more reliable, and do not strain the kidneys, reduce the blood, or depress the heart in feeble patients.* (See Cold and Fever.) When cold water cannot be used, then antipyrine may be employed. In *phthisis* antipyrine generally increases the sweating, produces oppression, and either fails to act as an antipyretic or causes collapse by exercising too great an effect. In *sunstroke* it frequently fails to influence the temperature, and ought not to be used.

Be the fever what it may, provided it be associated with any disease process, antipyrine is useless so far as any influence over the course of the disease itself is concerned. It is a remedy used in the treatment of the symptoms, not for the removal of the cause of the fever.

As an analgesic antipyrine is in some cases the peer of opium. Although the latter drug will relieve all forms of pain if it be pushed, it possesses many disadvantages not found in antipyrine. In deep-seated pains due to disease of the organs of the body, in inflammations and similar disturbances, antipyrine is useless. In *neuralgic* affections of all kinds it finds its sphere, particularly if the disorder be rheumatic, gouty, or due to nervous depression from nervous exhaustion or disease. Under the latter circumstances it is best combined with caffeine and a little bromide of potassium. In other cases a capsule containing 5 grains (0.3) of antipyrine and 5 grains (0.3) of chloral may be given to relieve pain and cause sleep. This combination undergoes deliquescence without impairing its usefulness. (See Neuralgia.) In *acute rheumatism* it will give relief in a fairly large number of cases, not only relieving the pain and fever if they be present, but also actually modifying the disease. It seems, however, to increase sweating in acute articular rheumatism. In *gout* it is stated to have a specific curative effect upon the disease over and above the relief of the pain, but this is questionable. A useful remedy in *gouty neuralgia* and *muscular rheumatism* is such a prescription as follows:

℞—Antipyrinæ	gr. xxiv (1.6)
Strontii salicylatis	gr. xlviij (3.0)
Elixiris aromatici	f℥iij (90.0) —M.

S.—Tablespoonful every hour for three doses in severe neuralgia, or three times a day for muscular rheumatism.

Its use in *dysmenorrhea* has been recommended, but its beneficial influence except in neuralgic cases is doubtful. At one time it was thought that its use would relieve the *pains of labor*, but this has, unfortunately, proved untrue. It may, however, be tried, when suffering is very severe, in the dose of 15 grains (1.0). In the severe lancinating or darting pains of *locomotor ataxia,* and in the laryngeal and gastric crises complicating this disease, antipyrine is a valuable remedy. Curiously enough, it seems to subdue acute attacks of pain in *posterior sclerosis,* but it fails to control the slighter pains and muscular twitchings sometimes seen in this disease and in *myelitis.*

Some clinicians have used antipyrine with asserted great success in *diabetes mellitus.*

Antipyrine may be used hypodermically (2 grains (0.15) to 20 minims (1.3) of water) in the region of a *hypersensitive nerve* as a local anesthetic. The anesthesia lasts for several days, but the pain immediately after the injection is severe unless preceded by procaine.

Antipyrine is sometimes a very useful remedy in modifying the severity of *epilepsy.* (See Epilepsy.)

In *whooping cough* antipyrine has more frequently given relief in the writer's experience than any other remedy. It should be given to a child of five years in the dose of 2 grains (0.12) every four or five hours, the patient being watched for cyanosis and the drug stopped as soon as this symptom appears. Antipyrine generally decreases the frequency rather than the severity of the attacks of cough.

In *malarial diseases* antipyrine certainly exercises no antiperiodic influence, although it controls the febrile paroxysms to a great extent. One cannot help thinking that frequently where antipyrine has been reported as acting as an antiperiodic it has simply lowered the fever, and so seemed to influence the disease.

In *acute coryza* the temporary relief produced by applying cocaine to the engorged Schneiderian membrane may be prolonged very greatly by the use of a solution of antipyrine in the strength of 4 per cent. This produces a smarting sensation, which speedily passes away. The same treatment is of value in inflammations of the larynx and pharynx. Should cocaine solutions not precede the antipyrine, the primary irritant effects persist unless the strength of the solution of antipyrine is reduced to 1 or 2 per cent. It is always better to precede its use by cocaine.

Locally applied, antipyrine possesses very distinct *hemostatic properties*, and for this purpose may be used in a 4 per cent solution, either in liquid or in a spray. Under these circumstances it seems to act not by producing clots, which are disadvantageous from the standpoint of antisepsis, but by constringing the bleeding vessels. This hemostatic property is very materially increased if a solution of tannic acid is added to it, when it forms a glutinous precipitate which controls the hemorrhage. The precipitate is best applied by means of a swab.

Antipyrine may be given with cocaine in *suppository* to check bleeding from *hemorrhoids* and relieve rectal pain. The cocaine must be used to prevent the antipyrine from causing pain when the suppository is first introduced.

Untoward Effects.—Aside from the results of poisonous doses, a certain number of cases taking this drug present slight cyanosis or duskiness of the hands and of the face about the nose and lips; the fingers may be cold and clammy, and the feet are often very cold; sweating is a very common symptom of the untoward influence of antipyrine, and pricking or tingling of the skin is not uncommonly seen. By far the largest number of these cases, however, suffer from disorders associated with the skin, and erythematous patches may be seen everywhere, more particularly on the hands and feet and about the face, arms, and chest. Occasionally pemphigus-like spots appear, and often large bullæ have been noted as present. Elsewhere are published the statistics, collected from medical literature, of 121 cases of untoward effects exercised by antipyrine.[1] An analysis of these shows that females were much more frequently affected than males, and that the most susceptible age was decidedly that of full adult life—namely, from thirty to forty years in both sexes. The dose causing these effects was most commonly a moderate one—from 10 to 15 grains (0.6–1.0), or even from 4 to 10 grains (0.25–0.6). This fact holds good with regard to both sexes. The time of onset of the symptoms varied somewhat according to whether the drug was given in one excessive dose or in frequently repeated *medicinal* doses. In many instances the appearance of the symptoms was sudden rather than gradual. As a rule, the duration of the symptoms did not exceed one to three hours, three days being the longest time mentioned. It is interesting to note, however, that of all these cases only 6 proved fatal, and in these there was ample cause for death aside from any effect of the drug. We can rest assured, therefore, in ordinary cases of disease that patients exhibiting untoward effects of antipyrine are not in any acute danger, although the symptoms may be temporarily most alarming. Typhoid fever seems according to the statistics collected by the writer, to be the disease in which this unexpected influence manifests itself most frequently, but this may be due to the fact that it is so common a malady and is so frequently treated by means of antipyretics. Brunton is responsible for the statement that antipyrine is particularly prone to produce collapse in menstruating women. Falck has collected a large number of cases of antipyrinism, and quotes Pusinelli as having seen vomiting often follow the use of this drug.

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[1] See author's Boylston Prize Essay of Harvard University, on Antipyretics.

Antipyrine very distinctly increases susceptibility of patients to taking cold, and ought not to be used by those who are forced to go out of doors in cold weather.

Administration.—Owing to the solubility of antipyrine, it is most readily given in a little water in a wineglass or spoon. If its slight taste is disliked, it may be dissolved in any one of the aromatic waters or in elixir of bitter orange peel or some similar vehicle. Most persons prefer to take it in tablet form. The amount which may be given at a dose is 5 to 20 grains (0.3–1.3), but 3 to 5 grains (0.2–0.3) is the best dose in most cases, at least until it is determined how well it is borne.

Incompatibles.—When added to sweet spirit of nitre, antipyrine in the course of a few moments produces a blue, changing to a dark green color, owing to the formation of iso-nitroso-antipyrine which is not poisonous, but which in the form of a dry powder is readily oxidized on exposure to slight heat. If this color is not formed, the spirit of nitre lacks its nitrous ether, and is worthless, so that we have not only another incompatibility to remember, but a new means of testing the therapeutic value of all samples of sweet spirit of nitre which may be dispensed. Antipyrine is also incompatible with the salts of iron, calomel, corrosive sublimate, and phenol. With salicylate of sodium it forms a pasty mass; with chloral an oily liquid. Betanaphtol and tannic acid are also incompatible with it. Tannic acid and non-alcoholic solutions of tannic acid form an insoluble precipitate with antipyrine as does also the tincture of iodine.

Paderi asserts that when antipyrine is mixed with calomel it forms a compound more poisonous than bichloride of mercury.

ANTITOXIN.

(See Part III.)

AOLAN.

(SEE PART III PROTEIN THERAPY.)

APIOL.

Apiol is a camphoraceous body, derived from common parsley or *Petroselinum.* As its melting-point is very low, it cannot be kept in solid form, and is always dispensed in 75 per cent solution. So far as is known to the author, no careful study of its physiological action has ever been made, but two French observers, Joret and Homolle, state that in overdose it causes ringing in the ears, intoxication and severe frontal headache.

Therapeutics.—Originally introduced to combat malarial fevers, because of a fancied resemblance in its toxic action to quinine, apiol has found its level as a remedy in *amenorrhea,* given in the dose of 2 to 8 minims (0.1–0.5) three times a day for a week before the expected date of menstruation. It should be given, if possible, in capsules, owing to its unpleasant taste. It is said not to possess any abortifacient influence, although it is often taken with this object in view.

Apiol is imported from France in capsules containing a little less than 3 minims (0.2), and is also put up in soft elastic capsules in the United States.

APOCYNUM.

Apocynum Cannabinum should not be confused with *Apocynum Androsimæfolium,* which has few of its properties, but which is often employed by mistake for the real drug. When good effects do not follow the use of the drug another sample should be tried. The remedy in overdose is capable of causing vomiting and purging through gastro-intestinal irritation, but in medicinal dose rarely does so. It is employed in medicine for the relief of *cardiac* and *renal dropsy* of the subacute or chronic type, and is best given in the form of the tincture or fluidextract in the dose of 5 to 20 minims (0.3–1.3) of the former or 1 to 5 minims (0.05–0.3) of the latter. Under its influence profuse diuresis occurs, and the fluid is said to be removed so rapidly that the drug has been called the "vegetable trocar."

Physiological studies show that the action of the drug on the heart is similar to that of digitalis, as it slows the pulse and raises blood-pressure. I have not obtained satisfactory effects from its use.

APOMORPHINE.

Apomorphinæ Hydrochloridum, U. S. and B. P. ($HCl.C_{17}H_{17}NO_2$) of an artificial alkaloid, prepared from morphine.

A very important point to remember is that its solutions rapidly decompose, and, if then employed, may produce poisonous symptoms. The drug ought to be freshly dissolved each time it is used. If the salt imparts an emerald-green color to 100 parts of water when shaken a few times it should be rejected.

According to Boyer and Guinard, there are two kinds of apomorphine sold. Each has a physiological effect different from that of the other. The crystalline form, which is the one always to be employed, causes, in overdose, irritation, spasms, trismus, vertigo, and hyperesthesia; while the amorphous form (never to be used) causes collapse, hypothermia, general weakness, feebleness of the heart and respiration, and anesthesia.

Physiological Action.—On the nervous centers in the brain apomorphine acts as a sedative in medicinal doses, but the convulsions produced by poisonous doses are probably spinal. The motor and sensory nerves are paralyzed by poisonous doses, and even the muscles become poisoned and incapable of contraction. Medicinal doses have no such effects.

Circulation.—When given in moderate amounts, apomorphine increases the rapidity and force of the pulse and raises arterial pressure by stimulation of the accelerator nerves and the vasomotor centers. In large doses it acts as a circulatory depressant.

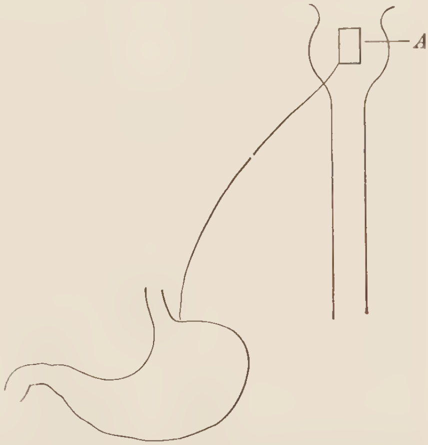

Fig. 10.—*A*, apomorphine stimulates vomiting center in the medulla.

Respiration.—After ordinary amounts no changes in respiration occur, but after poisonous doses the breathing becomes rapid and irregular.

Vomiting.—Vomiting is produced by a direct action of the drug upon the vomiting centers in the medulla, and not by an action on the stomach. Apomorphine is, therefore, a typical centric emetic.

Therapeutics.—Apomorphine is useful in nearly all cases where an emetic may be employed. In poisoning from other drugs, particularly depressants and narcotics, we have little knowledge of its safety, but unless the stupor or circulatory change is very profound, the drug may be used with care. Often a hysterical patient can be brought to her self by an apomorphine vomit. In subacute and chronic *catarrh of the stomach and air-passages* it may aid in getting rid of the mucus by emesis, and in non-emetic dose it is a useful remedy in *acute bronchitis* when the secretion is very scanty. Non-emetic doses, given hypodermically, of $\frac{1}{30}$ grain (0.002) have been used as often as every three hours with notable success in producing nervous quiet in *uremia, alcoholic excitement* and *delirium tremens,* and if combined with $\frac{1}{150}$ grain of hyoscine it is particularly efficacious in the latter states.

Untoward Effects.—Apomorphine rarely causes disagreeable effects, but there are cases on record in which it has produced serious symptoms even when given in ordinary doses. These symptoms have consisted in depression and collapse. One-fifteenth grain is said to have caused death in a woman who had bronchitis, but was otherwise healthy. Probably in these cases the amorphous form was used.

Administration.—The drug when used as an emetic should always be given hypodermically and the solution be freshly prepared. The emetic dose is about $\frac{1}{10}$ grain (0.006), but as much as $\frac{1}{5}$ grain (0.012) may be used in strong patients. The expectorant dose is $\frac{1}{40}$ to $\frac{1}{25}$ grain (0.0015–0.003) by the mouth. No nausea is usually felt. The drug nearly always acts badly in children, and it is better not to use it in this class of patients. The salt used is *Apomorphinæ Hydrochloridum,* U. S. and B. P. An injection (*Injectio Apomorphinæ Hypodermica*)—1 grain (0.06) dissolved in 110 minims (7.1) of distilled water with 1 minim (0.06) of diluted hydrochloric acid—is official in the B. P.

APOTHESINE.

Apothesine is a local anesthetic which is chemically the cinnamic ester of gamma-diethylamino-prophyl-alcohol hydrochloride. It appears in snow-white crystals and is readily soluble in water, in alcohol and slightly so in ether and acetone. It is said to be much less toxic than cocaine, and is used for exactly the same purposes, with or without adrenalin, for local and infiltration anesthesia and has proved generally efficient whenever a local anesthetic is indicated. It does not constrict the tissues as does cocaine. It is placed on the market in small hypodermic tablets, in crystals and in solution. The strength employed is usually 1 to 2 per cent in salt solution. It can be sterilized by boiling. It does not produce a habit and does not come under the narcotic law.

ARGYROL.

Argyrol is a proprietary salt of silver, which is far less irritating than nitrate of silver, but is not so efficient as a germicide or antiseptic. It is important to use freshly prepared solutions. Its lack of irritating properties has, however, rendered it popular in a large number of conditions in which the nitrate of silver has hitherto been used. In *cystitis* 1 ounce of a 10 to 25 per cent solution may be injected into the bladder and permitted to remain there some minutes before being passed or drawn off. When employed in *gonorrhea* a 16 per cent solution may be injected four times in the twenty-four hours with advantage. To prevent or relieve *ophthalmia neonatorum* the strength of the solution should be 25 per cent. Stains caused by argyrol can be removed by the use of a 1 to 500 solution of corrosive sublimate.

ARISTOL.

(See Thymol Iodide.)

ARSENIC.

Arsenic (*Arsenum*) itself is never employed in medicine, but it is used in the form of arsenic trioxide (arsenous acid) or as the arsenate of sodium, arsenite of potassium, or arsenate of copper. When a physician speaks of giving arsenic to a patient he usually refers to arsenic trioxide (*Arseni Trioxidum*, U. S.; *Acidum Arseniosum*, B. P.).

Physiological Action.—The effects produced in man by poisonous doses of arsenic will be found considered under the head of Poisoning.

Applied to the normal skin, arsenic trioxide produces no change of any moment, but if the surface be broken or a wound or sore exist, its action is very powerful, and it destroys the tissues to a considerable extent. For this reason it has been employed as a caustic by "quacks" and to some extent by regular physicians, the latter using it to remove warts, condylomata, and similar growths, while the former have employed it chiefly as a "cancer cure," asserting that it would take the disease "out by the roots," which is, of course, untrue.

Nervous System.—In medicinal amounts the drug probably acts as a stimulant to the trophic nervous apparatus.

Circulation.—In moderate amounts arsenic has little or no influence upon the circulation. Large doses cause marked decrease in the force and frequency of the pulse, accompanied by a decided fall in arterial pressure, and in these amounts it is to be regarded as a distinct cardiac depressant which depresses all the heart's component parts, such as the ganglia, muscle, and nerves. The fall of the arterial pressure is due to vasomotor depression with relaxation of the general bloodvessels, more especially those of the abdominal cavity. According to Lesser, small doses act as a cardiac stimulant. Arsenic is absorbed by the bloodvessels and by a process of osmosis.

Respiration.—In small amounts arsenic very distinctly stimulates the respiratory centers, and Lesser assserts that small dose stimulate the peripheral ends of the vagi in the lungs, but that in toxic quantities arsenic acts as a powerful respiratory depressant.

Absorption, Elimination, and Retention.—When arsenic in any of its soluble forms and in medicinal or moderately poisonous dose enters the body by way of the alimentary canal, or through a break in the skin, or by way of the lungs, it is speedily absorbed and distributed to all parts of the body by the blood and lymph. The rapidity of its absorption depends upon the activity of the circulation in the part with which it comes in contact, and when it is taken by the mouth upon the quality and quantity of the food and drink which may be present in the stomach. If these are considerable in amount, its absorption is of course delayed, as is also its local effect upon the mucous membrane. When brought in contact with the tissues in concentrated form, it acts so powerfully that it may destroy them and so for a time at least prevent its own absorption because the blood-vessels and lymph channels are prevented from carrying their normal fluids.

When the dose is medicinal or slightly toxic, the drug is eliminated chiefly by the kidneys, although it escapes to some extent by all the secretions, such as the bile, the sweat, the saliva, and even in the milk of nursing women, and it may produce in the nursling symptoms of gastro-intestinal irritation by this means. The rapidity with which it escapes from the body after it is absorbed varies greatly in different persons. It does not, as a rule, appear in the urine very promptly after it is taken, and it continues to be eliminated over a long period of time in some cases. Thus, cases are on record in which it was found in this secretion several months after its use had been stopped.

When a large poisonous dose of arsenic is taken by a human being, the greater part of it escapes from the body by reason of the vomiting and purging which it induces. It is possible for these efforts at elimination to be so prompt and complete that very little of the poison gains access to the general system. A large poisonous dose may therefore be less capable of producing death than one which is smaller in amount but nevertheless lethal in its effects. If the drug when taken in these poisonous doses is absorbed, it escapes, as it does in medicinal doses, chiefly by the kidneys, the feces, and by the other secretions named, and it is important to recall the fact that the amount of arsenic found in the feces does not represent alone that quantity which has passed through the alimentary canal unabsorbed, but also that it represents some of the poison which has entered the general system, because the liver and gastro-intestinal mucous membrane eliminate the drug by this pathway.

During the time the arsenic remains in the body after absorption it is deposited chiefly in the liver and in the kidneys, in the walls of the stomach and bowels, and even in the muscles and bones. Indeed the affinity of the liver cells for the drug tends to protect the rest of the body to their own detriment. It has also been stated that it is deposited in the white matter of the brain in quantities which are considerable. When seeking for arsenic in a case of suspected death from this cause it is important to examine the bones, because in some instances the drug is found in them after it is no longer to be found in other organs. It is from these "storehouses" of arsenic that eliminating organs obtain their daily supply for elimination. Arsenic is so rapidly eliminated in some cases of fatal poisoning that only a trace of it can be found on chemical analysis after death. (See also Poisoning by Arsenic.)

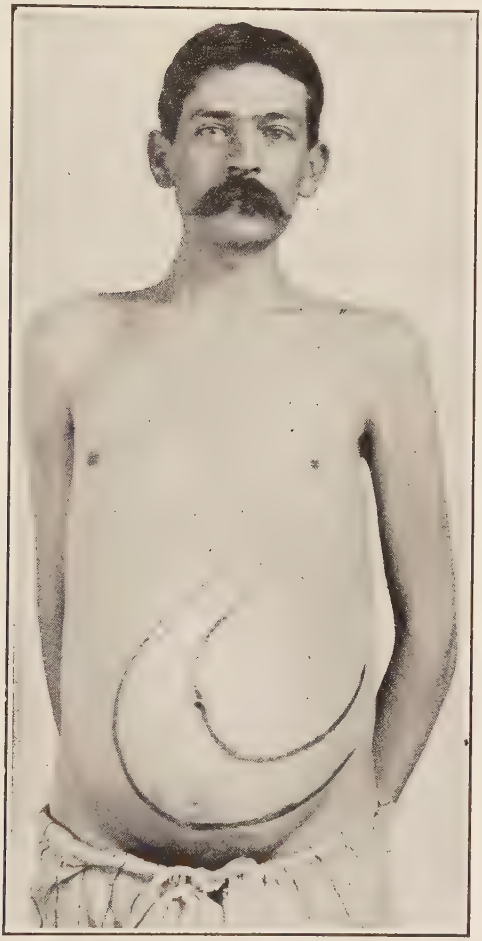

Fig. 11.—A case of typical splenomedullary leukemia in which under the effects of arsenic the spleen decreased in size more than one-half, as shown in outline, and the white cells dropped from 342,000 to 32,000. There was a gain in weight of twenty pounds.

Tissue-waste.—According to Chittenden and Cummins, arsenic in medicinal amount distinctly decreases tissue changes. Large doses, however, greatly increase nitrogenous metamorphosis.

Therapeutics.—Arsenic is used in *chorea,* in which it is often most efficient, acting in an unknown manner. The dose should be increased rapidly, as patients soon get accustomed to the drug, and large doses are essential to produce a cure in most cases. Cases are on record, however, in which the continued use of large medicinal doses has developed arsenical neuritis or renal irritation. As a tonic combined with iron it is invaluable in *simple anemia, malarial anemia,* and *cachexia.* In *atony of the mucous membrane* of the stomach and intestine it is exceedingly useful, and in ordinary *anemia* and *debility,* combined with a simple bitter tonic, it is invaluable. Arsenic is of value, too, for the improvement of *depressed mucous membranes* of the respiratory tract, particularly in those persons who have not true tuberculosis, but *tuberculous tendencies;* and in individuals who continually have colds in the head, chest, or elsewhere. Arsenic is one of the best drugs in the treatment of *pernicious anemia,* but how it acts is not known, probably by stimulating the bone-marrow. In *leucocythemia* and *pseudoleukemia* arsenic is again the remedy, and it must be constantly given up to the point of intolerance to be of value (Figs. 11 and 12). In the latter disease good results have followed its use when intraglandular and intrasplenic injections of 4 minims (0.25) of Fowler's solution were used, and a case of severe anemia, in which the stomach is disordered, may be treated by giving by the rectum in starch-water three times the ordinary dose by the mouth or by its use hypodermically in the proportion of 4 parts of water to 1 of Fowler's solution. (See Sodium Cacodylate.)

In *malaria* arsenic acts as a prophylactic, as a cure, and as an aid to convalescence. It probably acts chiefly by increasing vital resistance rather than by any direct effect on the parasite. When the attacks of *intermittent fever* occur at long intervals arsenic is useful as an antiperiodic, quinine being withheld for use during the attack itself. (See Arsphenamine.)

No drug is so universally abused as is arsenic in the treatment of skin diseases: it should never be employed in "wet" skin diseases; that is, those associated with much proliferation of new cells and the exudation of serum. Its field of usefulness is in the *dry, scaly skin affections.*

When the skin is affected in its lower layers arsenic is useless, and should be used only when the epiderm is diseased (Duhring).

In *psoriasis* arsenic at first makes the skin more red and seemingly worse, but this passes off and the patient gets well. This is important to remember, as otherwise the drug may be stopped just when doing good. *Pemphigus, lichen* and *lepra* all yield to its influence in many instances.

In the treatment of *diabetes* and *pruritus vulvæ* the drug is said to be of value when given internally. In *gouty diabetes* the use of the carbonate of lithium and the arsenate of sodium is often of service.

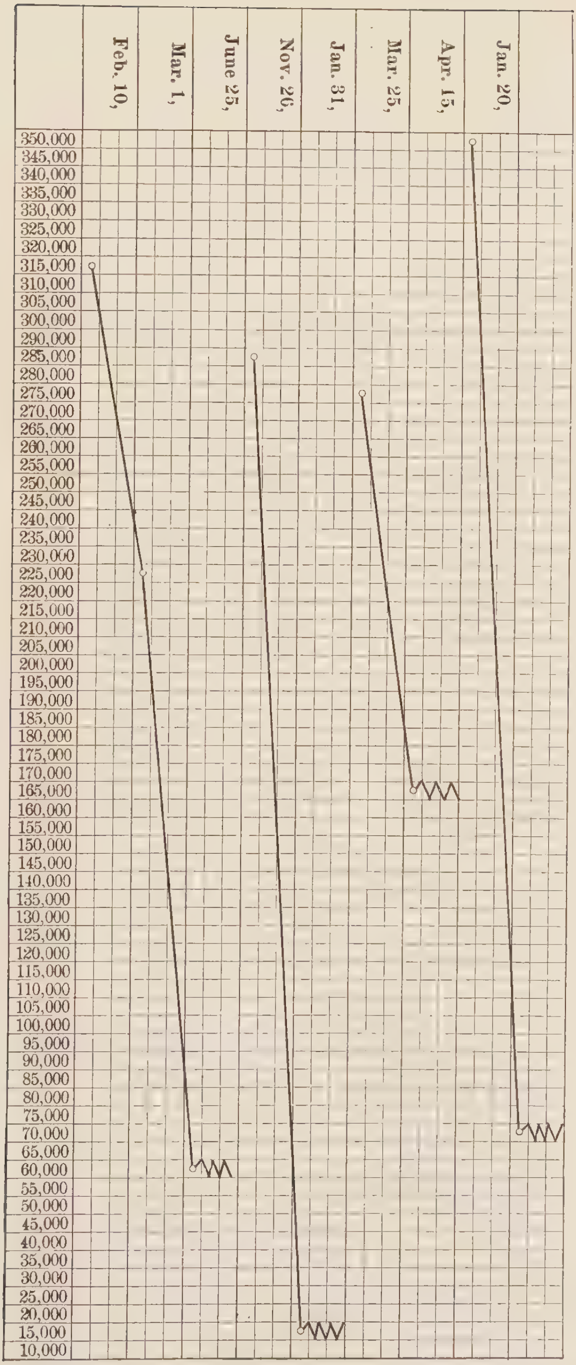

Fig. 12.—Chart showing the decrease in the number of the white blood cells each time a patient suffering from splenomedullary leukemia received ascending doses of arsenic and had rest in bed.

In *asthma*, particularly when the mucous membranes are at fault, arsenic is one of the best remedies that we have, either given internally or smoked in arsenic cigarettes, which are to be made as follows:[1]

℞—Belladonnæ foliorum	gr. xcvi (6.4)
Hyoscyami foliorum	gr. xlv (3.0)
Stramonii foliorum	gr. xlv (3.0)
Extracti opii	gr. iv (0.25)
Tabaci	gr. lxxx (5.3)
Aquæ	Oj (480.0).—M.
Fiat infusio et adde	
Potassii nitratis	gr. clx (10.6)
Potassii arsenitis	gr. cccxx (21.3).—M.

Bibulous paper is to be wetted with this compound, and after drying is to be rolled up and smoked as a cigarette.

A more simple procedure is to wet bibulous paper in a solution of arsenite of potassium of the strength of 15 grains to the ounce, dry it, and smoke it in the form of a cigarette.

In *chronic rheumatism* arsenic is a very valuable tonic in certain cases, but often fails to be of service. In *chronic coryza*, in *cancrum oris, severe sore-throat, and chronic nasal catarrh* it is to be employed internally, and in some cases of *hay fever* undoubtedly affords relief. The use of arsenic in all stages of *phthisis* often gives the most surprising results. In *gastric cancer* and *ulcer*, given in small amounts frequently repeated, arsenic will often do good by relieving the pain and checking the vomiting through its tonic influence on the gastric mucous membrane. It may be tried in the *vomiting of pregnancy* with some chance of success, and is often of value in the *vomiting of hand-fed babies* who are suffering from chronic gastric catarrh. It is also useful in the *morning vomiting of drunkards*. In *atonic dyspepsia* associated with *chronic diarrhea* and with a tendency to *dysentery* arsenic trioxide is of service, and in small amounts it is very valuable in frequently repeated doses ($\frac{1}{100}$ grain [0.0006] every hour) in all forms of *serous diarrhea*.

For *gastric atony* or *torpidity* the following prescription is useful, but if irritation of the stomach is present it should not be employed:

℞—Liquoris potassii arsenitis		f ʒi (4.0)
Tincturæ nucis vomicæ		f ʒj (4.0) vel f ʒij (8.0)
Aquæ	q. s. ad	f ℥iij (90.0).—M.

S.—Shake the bottle. Teaspoonful (4.0) t. i. d. in water after meals.

℞—Arseni trioxidi	gr. ⅓ (0.02)
Ferri reducti	gr. x (0.65)
Extracti nucis vomicæ	gr. iv (0.24).—M.

Fiant pilulæ No. xx.
S.—One t. i. d. after meals.

In old persons whose *feet become swollen* and hot after prolonged standing, and who have *shortness of breath* on exertion, arsenic does good, particularly if the cause be cardiac feebleness, when it increases the efficacy of digitalis or strychnine so greatly as to be generally indicated when these drugs are given.

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[1] Philadelphia Hospital Pharmacopœia.

Locally applied to *warts* and other growths of the skin for several days in the form of *Liquor Arsenicalis* (B. P.) or *Liquor Acidi Arsenosi* (U. S.) or of Fowler's solution, it causes the growth to drop off or to become loosened. Where the growth is very hard and horny, its surface should be softened by the application of potassii hydroxidum before the arsenical liquor is applied. The same treatment may be used for *corns*.

Where large malignant growths with extensive surfaces are to be attacked locally, the physician must use arsenic most boldly or not at all. The danger of absorption is escaped only when the drug is used so freely as to destroy the tissues before they can carry on any absorption of the poison. A very large area should not be treated at one time. Marsden recommended the use of 1 ounce (30.0) each of arsenic trioxide and powdered gum acacia to 5 drams (20.0) of water as an application to *epitheliomatous growths*. A less painful application because of the anesthesia caused by orthoform, is as follows:

℞—Orthoformi	ʒj (4.0)
Arseni trioxidi	ʒj (4.0)
Alcoholis	f℥v (150.0)
Aquæ destillatæ	f℥v (150.0)

Still another is:

℞—Arseni trioxidi	gr. lxxv (5.0)
Pulveris acaciæ	gr. lxxv (5.0)
Cocainæ hydrochloridi	gr. xxx (2.0)
Glycerini	♏xxx (2.0)
Aquæ destillatæ	q. s.

M. ft. paste.
S.—Apply locally.

The Marsden paste should be applied to the thickness of about one-quarter of an inch, overlapping the edges of the sore, and then covered with patent lint. The application is continued from twenty-four to forty-eight hours, and then a poultice is applied and the slough removed after from five to ten days.

Administration.—Children generally bear arsenic better than adults. proportionately, but Ringer states that boys bear less than girls, The drug should be given before meals if it is designed to act on the stomach as a tonic, but in other conditions it should generally be administered after meals, as it is apt to irritate the stomach if given in full doses when this viscus is empty. Whenever a patient is given arsenic, he should be cautioned to watch for any puffiness about the eyes, particularly in the morning on arising, and for slight laxity and griping of the bowels. These are signs that the drug should be stopped for several days. The swelling under the eyes may spread if the use of the drug is persisted in, and finally amount to general anasarca. This is due at first to a cellulitis, and afterward to a true effusion. (See Untoward Effects.)

It is important from a medico-legal point of view to bear in mind the fact that arsenic is one of those drugs to which it is possible to induce tolerance. That is to say, by the prolonged and gradual administration of arsenic in ascending doses individuals can finally take very large quantities with apparent impunity. Cases are recorded in which as much as 7 grains could be taken at one dose without any evil effects.

The official preparations are: *Arseni Trioxidum*, U. S.; *Acidum Arseniosum*, B. P., the dose of which is $\frac{1}{40}$ to $\frac{1}{20}$ grain (0.0015–0.003)—$\frac{1}{60}$ to $\frac{1}{15}$ grain (0.001–0.004) B. P.; the solution of the arsenite of potassium (*Liquor Potassii Arsenitis*, U. S.; *Liquor Arsenicalis*, B. P.) or Fowler's solution, the dose of which at first is from 1 to 5 minims (0.06–0.3)—2 to 8 minims (0.12–0.48), B. P.—in water; the solution of arsenate of sodium (*Liquor Sodii Arsenatis*, N. F. and B. P.), or Pearson's solution, the dose of which is 1 to 5 minims (0.06–0.3)—2 to 8 minims (0.12–0.48) B. P.—and the solution of arsenous acid (*Liquor Acidi Arsenosi*, U. S.), the dose of which is 1 to 5 minims (0.06–0.3). This is more irritating to the stomach than the other preparations. Arsenous iodide enters into Donovan's solution (*Liquor Arseni et Hydrargyri Iodidi*, U. S.; *Liquor Arsenii et Hydrargyri Iodidi*, B. P.), the dose of which is 1 to 5 minims (0.06–0.3)—5 to 20 minims (0.3–1.2), B. P.—given well diluted. Arsenous iodide (*Arseni Iodidum*, U. S., *Arsenii Iodidum*, B. P.) is given in $\frac{1}{100}$ to $\frac{1}{20}$ grain (0.0006–0.003)—$\frac{1}{20}$ to $\frac{1}{5}$ grain (0.003–0.012), B. P. doses, and arsenate of sodium (*Sodii Arsenas*, B. P.) in the dose of $\frac{1}{100}$ to $\frac{1}{20}$ grain (0.003–0.0006)—$\frac{1}{40}$ to $\frac{1}{10}$ grain (0.0015–0.006). *Liquor Arsenici Hydrochloricus* is also official in the B. P.

Untoward Effects.—If arsenic is taken in full dose by a susceptible person, it may cause a marked dermatitis, with a sensation of severe burning in the skin and sometimes herpes zoster (Fig. 13). Pustulation may occur, and Falck asserts that an erysipelatous state may arise. Almost any form of skin lesion may follow its use internally or externally, but nearly all show irritation of the true skin. Even a scarlatiniform eruption followed by desquamation may ensue. In other cases the mucous membranes become inflamed and coryza may develop. (See Administration.) The prolonged use of arsenic, according to de Schweinitz, may produce vitreous opacities.

Acute Poisoning.—The symptoms of acute poisoning by arsenic, that is, those following the ingestion of one or more large doses of the drug, are chiefly due to its irritating properties, but in part to the effects which it exercises upon the general system after it is absorbed. Usually within an hour after the poison is swallowed the patient experiences abdominal distress, a sense of constriction in the pharynx, esophagus, and in a short time suffers from violent abdominal pain with vomiting and later profuse serous diarrhea. As soon as the bowel has been well emptied of its feces this diarrhea becomes a symptom which is to some extent pathognomonic, that is to say, the stools become clear and may be like the so-called rice-water stools of cholera, containing flakes of mucous membrane floating in serum. These stools also appear in antimonial poisoning, but in arsenic they are often streaked with blood, whereas in antimonial poisoning blood is rarely if ever seen. The urinary flow is decreased, and it may be suppressed because of three factors: (*a*) the profuse purging drains the body of fluid; (*b*) the passage of the arsenic through the kidneys produces an intense toxic nephritis; (*c*) the vomiting prevents the ingestion of water. If urine is secreted it is concentrated and albuminous.

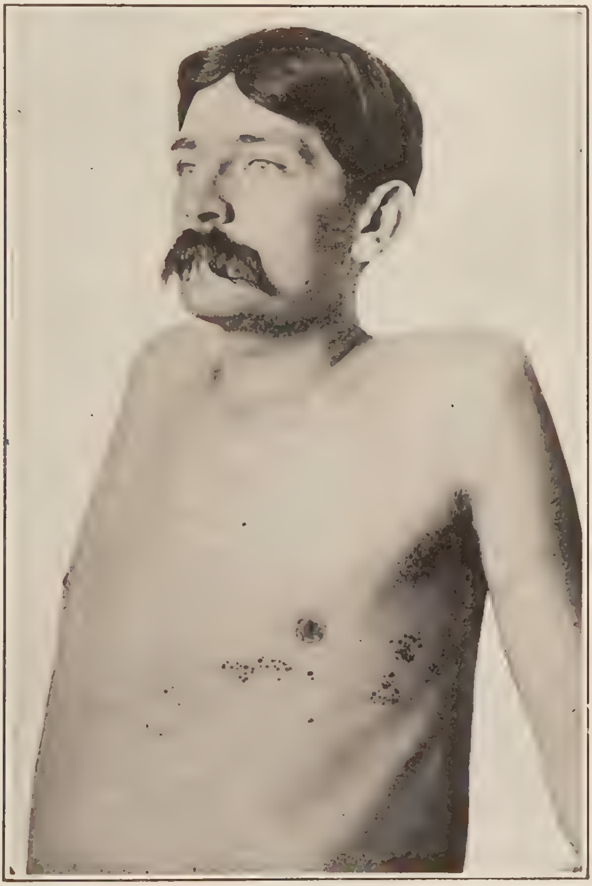

Fig. 13.—Herpetic eruption along the course of an intercostal nerve due to the use of 16 drops of Fowler's solution three times a day.

The general symptoms associated with those just described consist in pains in the extremities, probably due to the abstraction of fluid by the purging, great general depression and collapse, with increasing feebleness of the circulation and respiration, and finally death from the general intoxication produced by the drug, combined with exhaustion. As death approaches convulsions or coma may develop. Very commonly about the third day, if the patient survives so long, an intermission in the symptoms appears, which will be followed by a return of all the symptoms, so that the physician must not give a favorable prognosis. In this symptom (remission) the course of arsenical poisoning resembles phosphorus poisoning and yellow fever. Death generally occurs about the fourth or sixth day, and on or about the third day a peculiar skin eruption sometimes appears which may be of any character. In rare cases sudden pain, collapse, and death may take place within twelve hours after the ingestion of the poison or unconsciousness or heavy sleep, with entire absence of gastro-intestinal symptoms ensues, death speedily coming on. Widespread multiple neuritis may be developed if the case survives for several days.

It is to be remembered that acute arsenical poisoning may resemble poisoning by any substance capable of producing intense gastro-intestinal irritation. The symptoms may also be closely allied to those of cholera morbus and Asiatic cholera, while in some patients the predominance of nervous twitchings and the coma may be confusing.

After death from acute arsenical poisoning certain definite lesions are found, which are as follows: The mucous membrane of the stomach and bowel is reddened and inflamed, and it may be dotted by areas of hemorrhagic exudate. This is not due, however, solely to a corrosive influence of the poison, for arsenic is not, strictly speaking, a corroding drug, as are the mineral acids, for example. The epithelial lining of the alimentary canal is easily slipped off as if corroded, but the actual lesion consists in the degenerative changes produced in it and the finer bloodvessels by the poison. Filehne has expressed the opinion that the epithelium is primarily devitalized by the arsenic and then softened and digested by the digestive juices. There is also present a severe diffuse toxic nephritis, and in the lower animals and perhaps in man marked changes in the suprarenal bodies. A typical change always present in acute poisoning when the patient lives for any length of time is *fatty degeneration of all the viscera.*

The exact fatal dose of arsenic trioxide is unknown because the individual susceptibility and readiness of absorption vary greatly. It is generally considered that from 1½ to 2½ grains is a lethal dose. Smaller amounts than this have, however, caused death and much larger ones have been survived.

Only an infinitesimal amount of arsenic may be found on chemical analysis in toxic cases in the liver, bones, hair and nervous system. From a medico-legal standpoint, and also from an ordinary clinical point of view, the point to be borne in mind is that although some days elapse after arsenic is ingested before it can be recovered from the hair, on the other hand, traces of it often remain in the hair after its elimination from the internal organs is complete. An analysis of the hair is, therefore, important in all instances where arsenic is suspected as an etiological agent. (See Chronic Poisoning.) (See Arsphenamine.)

Treatment of Acute Poisoning.—In addition to washing out the stomach by the stomach-pump, applying external heat and stimulants, the ingestion of the proper antidotes should be at once employed, and the only ones of any value are the freshly precipitated hydrated sesquioxide of iron and magnesium oxide. (See below.) The first is to be prepared by the precipitation of iron from one of its fluid preparations by the use of an alkali. Ammonia added to the tincture of the chloride of iron is efficacious, but the precipitate has to be repeatedly washed to rid it of an excess of this irritant. Magnesia is a better precipitant, because it not only precipitates the iron, but is also an antidote itself. Monsel's solution and the so-called dialyzed iron may be employed in place of the tincture, but Monsel's salt is too irritating. Magnesia is of some antidotal power when given alone. Under the name *Ferri Hydroxidum cum Magnesii Oxido*, the U. S. P. recognizes an antidote for arsenic; this is often called the "*antidotum arsenici.*" It is prepared as follows: Place 40 cc. of solution of ferric sulphate (*Liquor Ferri Tersulphatis*, U. S.) with *125 cc.* of water, and keep the liquid in a large, well-stoppered bottle. Rub 10 grams of magnesium oxide with cold water to a smooth and thin mixture, transfer this to a bottle capable of holding about *1000 cc.*, and fill it with water to about three-fourths of its capacity. When the preparation is wanted for use, shake the magnesium oxide mixture to a homogeneous, thin magma, add it gradually to the diluted solution of ferric sulphate, and shake them together until a uniform, smooth mixture results.

Studies by McGuigan and Atkinson have recently proved that this antidote is practically valueless chemically, although it may delay absorption slightly. Unfortunately they offer no substitute.

In its stead and as time is a large factor in acute arsenical poisoning the following preparation may be used. Place 1 ounce (30.0) of tincture of ferric chloride in an ordinary drinking glass, add 1 ounce (30.0) of sodium bicarbonate with 8 ounces (240.0) of warm water. Stir thoroughly and give in one dose. Perform lavage and repeat dose in ten minutes.

After the use of the antidote emetics should be used, opium should be administered to allay irritation and pain, and large draughts of water be given to flush the kidneys and dilute the poison. In the later stages the danger from arsenical poisoning arises from the changes produced in vital organs.

Subacute Poisoning.—When the dose of arsenic has not been large enough to produce death rapidly the symptoms manifested are somewhat modified. The vomiting and diarrhea are less severe, but the abdominal tenderness and distress are notable. The kidneys are manifestly irritated by the drug, for the urine is scanty, bloody, or albuminous. In these cases sufficient time elapses for the secondary nervous lesions produced by the drug to result in outbreaks of various eruptions on the skin and for localized palsies due to neuritis to ensue. (See Chronic Poisoning.) The mouth is parched, thirst is excessive, the liver is enlarged and tender, and the skin hot and dry.

Chronic Poisoning.—Arsenic very frequently gains access to the body in many remarkable ways. It may be taken in cheap beers made from glucose, which in turn has been made with sulphuric acid prepared from iron pyrites contaminated by arsenic. In other instances it is obtained from wall-papers laden with arsenical pigments; in still other instances it occurs in artisans who handle arsenic-bearing ores in large amounts, and it is a curious fact that a common result in such persons is the development of a perforating but painless ulcer of the cartilaginous portion of the nasal septum. In rare instances the ingestion of a few large doses which usually produce acute poisoning has resulted in subacute or chronic poisoning because of slow absorption and rapid elimination. Chronic poisoning may ensue by the drug entering by the mouth, lungs, or skin.

At the New York Skin and Cancer Hospital it has been found that a very large number of cases of eczema have their origin in the continued use of various fruits or vegetables which have been sprayed with arsenical insecticides. This fact has been confirmed by the U. S. Bureau of Drugs and Insecticides.

Vogel has also reported many instances of grave liver and other forms of disease due to the unsuspected entrance of arsenic into the body. This possesses great medico-legal importance in cases in which intentional poisoning is charged since the arsenic may have entered the body from an innocent source. (See Acute Poisoning.)

The symptoms of chronic arsenical poisoning may for convenience be divided into three classes, although they are not so separated in the patient as a rule, being often interwoven in such a manner as to make a diagnosis difficult. In one class we find pigmentation of the skin, and nervous symptoms due to inflammations of the nerves, such as sharp attacks of pain, tingling in the extremities, patches of anesthesia, and localized loss of motor power. Thus it not infrequently happens that there develops paralysis of the extensor muscles of the toes or of the peroneal muscles. In other cases the flexors of the foot suffer chiefly, while in still others the feet escape and the hands are involved in the loss of power. In cases of acute poisoning the paralysis may appear as early as the third day, while in other cases it may be delayed several weeks. The anesthetic areas are generally confined to the extremities, and extend only to the first or the second joint above. Sometimes the multiple neuritis caused by arsenic gives rise to symptoms which resemble those of locomotor ataxia. White atrophic lines across the nails of the fingers and toes are often seen.

In other cases the manifestations of irritation of the mucous membranes are the predominant symptoms associated with disturbances in the nutrition of the skin, so that eruptions are produced, with falling of the hair and the development of cachexia. When the poison is inhaled, violent attacks of coryza or of asthma may occur and chronic bronchitis ensue. In some instances jaundice and even symptoms of acute yellow atrophy of the liver may be present. The fact that chronic arsenical poisoning may closely resemble natural disease is an important one. The urine may not show arsenic, and even after death a careful microscopic and chemical examination may be required to reach a diagnosis.

Thiosulphate of sodium may be given to aid in the elimination of arsenic, not only to mitigate symptoms but also to set free arsenic in the urine and feces, which may not contain it until this drug is used, thereby enabling the chemist to discover the poison.

Chronic arsenical poisoning must be differentiated from chronic lead poisoning and chronic alcoholism. All three of these states may occur simultaneously. From lead poisoning it is to be separated by the absence of the blue lines on the gums, by the fact that in plumbism there is rarely much disturbance of sensation and that the motor palsy of lead commonly affects the extensors of the forearm rather than the muscles of the leg, as does arsenic. The history of the patient is also of great aid in the differentiation. It is also said to be a fact that muscular atrophy is more rapid in its progress in arsenic intoxication than in that due to lead. In lead poisoning eruptions and discolorations of the skin are rare.

Alcoholic neuritis is to be differentiated from arsenical poisoning by the history and appearance of the patient, by the absence of disorders in the skin, and by the presence of mental deterioration.

Chronic poisoning is to be treated by withdrawal from the exposure and by the use of iodide of potassium to aid in the elimination of the arsenic. The special symptoms are to be treated by the application of electricity, tonics, out-of-door life, and such measures as will improve the general condition of the patient. (See Arsphenamine.)

ARSPHENAMINE.[1]

Arsphenamina (U. S.) sometimes called Arsenobenzol, "606," or, more correctly, dioxy-diamido-arsenobenzol dihydrochloride, is a fine yellow powder, readily soluble in water, methyl alcohol (1–3), and in glycerin, but less soluble in ethyl alcohol, and is insoluble in ether.

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[1] Arsphenamine is the name of the American product whereby use of the German product called salvarsan is avoided.

Arsphenamine appears on the market in ampoules holding varying quantities as follows: 0.2 gram, 0.3 gram, 0.4 gram, 0.5 gram, 0.6 gram. It depends chiefly for its therapeutic power upon its content of arsenic. Owing to the fact that it is readily oxidizable it is kept in small ampoules in a vacuum. For this reason the contents of an ampoule when opened should be used at once, and none of the drug saved for another dose, as any change in its composition makes it poisonous. Neo-arsphenamine is now used nearly five times as often as this, the original drug. (See Neo-arsphenamine, Sulpharsphenaamine and Tryparsamide.)

Physiological Action.—Arsphenamine when first introduced was supposed to act by reason of the fact that it combined with and destroyed the protoplasm of certain parasites found in the blood and tissues without damaging the protoplasm of their host, destroying the Treponema pallida, the spirillum of relapsing fever, and the Trypanosomes of sleeping-sickness. Ehrlich believed that its action is indirect and is of the nature of complement-fixation reaction, and stated that arsphenamine does not destroy the spirochete *in vitro* but only *in vivo;* Schamberg tells me, however, that arsphenamine does destroy spirochete *in vitro.* Unna has advanced the theory that the cells of the body are rich in oxygen whereas the spirochete is poor. Therefore, the arsphenamine by combining with its oxygen readily asphyxiates the parasite because its lack of nucleic acid prevents it from taking up oxygen freely. On the other hand, Schumacher advances the idea that the trivalent arsenicals, unlike the pentavalent arsenicals, have a special affinity for the lipo-proteid of the spirochete and that this at least in part explains the fact that in neurosyphilis the trivalent arsenicals have a high toxicity and relatively little spirocheticidal effect because the rich content of lipo-proteids in the nervous system takes up nearly all the arsenic and leaves little free arsphenamine to destroy the spirochete. Both of these views have been combated. Whatever views may prove correct it is pretty positively proved that the action of the drug is not as directly parasiticidal as was at one time thought to be the case.

It is not to be forgotten that one dose of arsphenamine is useless for it has been proved that ten to twenty doses are nearly always essential and even this number may not succeed in eradicating the disease if the infection is an old one. This is particularly true in cases in which the infection is chiefly manifested in the nervous system. Indeed in such instances it often entirely fails.

Elimination.—Arsphenamine is broken up in the body and eliminated as arsenic. When given intravenously only about 13 per cent of the arsenic is eliminated in fourteen days. Gougerot asserts that its elimination begins in one-half hour and reaches its peak in about eight hours. Some of it escapes in the feces and some is detained in the internal organs. Jesionek found it in the urine during the fourth week after an intravenous dose of only 0.4 gram. The eliminative process is even more slow when it is used intramuscularly. Its slow elimination may possess great medico-legal importance in toxicological cases, since the finding of arsenic in the body would fail to convict an alleged poisoner if it could be shown that at any time in the past the victim had received this drug for any purpose. Jeanselme, Vernes, Butrand and Bloch, in a joint report, state that the arsenic is chiefly found in the liver, spleen, the lungs, and the kidneys.

Therapeutics.—The chief use of arsphenamine is the treatment of *syphilis* in all its stages, but particularly the acute form, as represented by mucous patches, skin affections, and the chancre. When the disease has existed long enough to result in the destruction of tissue, arsphenamine cannot be expected to cause the regeneration of tissue which is destroyed.

Arsphenamine may be said to have the following scope of usefulness and limitations:

1. Arsphenamine is not to be resorted to in haphazard manner, as we are using a tool with a very sharp edge. In the presence of severe, fulminating syphilis in an acute form it should always be used, barring extraordinary contraindications.

2. It is to be recalled that inadequate doses of arsphenamine not only fail to cure the disease but also produce a strain or breed of spirochetes which are so immune to its effects that large doses given later may also fail.

3. Given within two weeks of the initial lesion it may, if given in repeated doses, produce a complete cure so far as we at present know, although years must pass before this is determined.

4. Given to a patient with active lesions on the penis, or elsewhere as the point of infection, and mucous patches in the mouth, it exerts a marvellous influence, so that these lesions speedily become sterile, sometimes after one dose, and often heal promptly. Its power to produce a true cure diminishes as each week goes by, and after secondary symptoms are well established it fails unless associated with mercurial injections. This is proved by the frequent recurrence of relapses, particularly in nervous syphilis (see No. 6) and in cases of gumma. In other words, arsphenamine relieves the symptoms of syphilis, but does not always eradicate the infection and the aid offered by mercury is essential.

5. The mild lesions in the skin in the secondary stage are affected apparently no better by arsphenamine than by mercury skilfully used, but severe ulcerative lesions are affected better by the new drug than the old.

6. Gummatous lesions of the skin yield better than with mercury, but gummata of internal organs are equally well affected by mercury.

7. In the cases in which syphilis of the nervous system is present it often fails, not only because degenerative changes have occurred which cannot be repaired, but also because it has been found that arsphenamine when in the blood cannot readily enter the cerebro-

spinal fluid in any quantity, since the tissues do not seem permeable to it, that is, the cells which secrete the fluid are slow to allow such complex molecules to pass through them. It has been found that relapses occur in late nervous syphilis treated by arsphenamine more frequently than when treated by mercury, and that nervous symptoms may become accentuated by its use, probably by development of a Herxheimer reaction.

8. A course of arsphenamine injections should be followed by a careful course of mercury in the form of intramuscular injections of 1 cc. of a 1 per cent solution of mercury biniodide or of gray oil or the protiodide by the mouth, since there is no doubt that mercury does good in syphilis that arsphenamine cannot do. A dogmatic statement, which like all dogmatic statements is not entirely true, is that arsphenamine and its related substances are most efficient for attacking free-moving spirochetes, whereas mercury is best for attacking parasites already imbedded in the tissues because it has the power to remove exudates and so expose the invader to the arsphenamine on the one hand or to its own spirocheticidal effects on the other. (See Mercury.) (See below.)

9. Given to a syphilitic mother it produces antibodies in the blood and milk, whereby a favorable effect can be produced in a nursing infant suffering from syphilis.

10. Arsphenamine seems to be even more of a specific in yaws, trypanosomiasis, and relapsing fever than in syphilis. It is also useful in malaria. (See Cinchona.)

11. The so-called Wassermann reaction usually disappears under the influence of arsphenamine, but when a patient with a history of syphilitic infection of long standing gives a negative Wassermann reaction it is sometimes possible to produce a positive reaction by giving a series of small doses, that is, the drug may be used as a diagnostic agent. This is called "provocative dosage." It is not to be forgotten that a positive reaction from a provocative dose may not appear for from two to seven days.

12. Brocq well says: "Whatever be the power of the new arms which have lately been placed at our disposal for the treatment of pox, the practitioner must clearly understand that the old rules of therapeusis have not undergone any change. He must grasp the idea that his duty is first and foremost to place the organism in the best possible state to resist and thus minimize the virulence of the infection; that by a well-ordained hygiene he may reduce to a minimum the secondary manifestations and the tertiary liabilities."

When syphilitic symptoms are urgent and no contraindications are present (see page 141) Ehrlich advises 0.6 gram doses given intravenously at intervals of four days, but the intravenous dose varies with the character of the disease, the general health, the age, and sex. In nervous diseases due to syphilis Ehrlich states the average dose to be 0.2 gram (3 grains) as a maximum. In ordinary primary syphilis, particularly if it be severe, the maximum dose should be 0.5 to 0.6 gram (6-10 grains). Women usually receive 0.4 to 0.5 gram (4–7 grains); children, 0.2 to 0.3 gram (3–5 grains). So, too, a feeble patient should not receive more than the dose for a child. When the dose is repeated it is rarely given until eight days have elapsed, and often not for two weeks, but in rare cases it may be used every other day. If the reaction due to the destruction of the parasite is severe, the second dose should be postponed or, if this is inadvisable, it should be smaller. When the disease is severe or persistent, 6 to 8 doses are to be given within two or three weeks. In ordinary cases after a course of 8 or 10 injections, 6 to 8 intramuscular injections of biniodide of mercury (gr. $\frac{1}{6}$) given at intervals of every other day for 12 doses are advisable. This double treatment is to be resorted to two or three times at intervals of three months. Three or 4-good-sized doses in the presence of active secondary symptoms, followed by mercury, may suffice; but this is rarely true, and what seems to be a cure of the disease results in latent syphilis which ultimately wrecks the cardiovascular-renal tissues or manifests itself in the nervous system. Warthin, writing as a pathologist, emphasizes these points in these words:

"The therapeutic lesson is evident. Promises of cure within definite time-limits can never be safely made, and our advice as to treatment must include the possibility of treatment extended over many years. The syphilitic must be treated as a germ carrier. The latency of the infection seems to be the same in many untreated cases as in those receiving very good treatment. Our present-day treatment seems only to succeed in rendering the infection latent rather than in curing it. Clinical cures may not be cures at all, as shown by the autopsy." For these reasons the physician should always keep up the treatment until the Wassermann test of the blood is negative. At the end of a year if the blood is still negative a small so-called "provocative dose" is to be given. If the Wassermann is still negative the spinal fluid should be tested and if it is negative then the luetin test should be used; when if this is also negative the patient may be considered probably cured.

Probably, from the standpoint of absolute accuracy, it would be better to say that while a large proportion of patients will be cured, a certain percentage can never have the disease completely wiped out. Fortunately the transmissibility is limited by the course of the disease itself, and this is hastened by treatment. A patient who gives the negative tests just referred to may marry two or three years after infection with no fear of transmission if actively treated from the early stage, as a rule.

The idea that by the use of arsphenamine natural processes by which the disease is combated are impaired has been advanced, but no less than 100 German and Austrian syphilographers have published a sharp denial of this view in a conjoint paper. (*Dermatologische*

Wochenschrift, March 3, 1928). They also deny that aortitis is of more frequent occurrence if it is used.

If the symptoms are more advanced, as in tertiary syphilis with a positive Wassermann or luetin test, treatment must be continued for a long time with mercury, but in general terms it may be stated that if a patient gives a history of an old infection, or if in the course of routine examination, a positive Wassermann test is developed, he should not be treated if no symptoms attributable to syphilis are present. This, of course, only holds in case of an infection years before and not in an acute case. In other words, an old specific history and a positive test do not indicate treatment in themselves. (See Mercury.)

In neurosyphilis arsphenamine is largely used but it is not as safe and perhaps not as efficient as sulpharsphenamine or tryparsamide (which see).

When Ehrlich first introduced arsphenamine his idea was to give one large dose to destroy the spirochete at one stroke, because it was feared that the microörganism might become resistant to the drug if exposed to the moderate effects gradually. Ehrlich's view has been found to be erroneous, although it holds true with sufficient force to make it inadvisable to give very small doses over long periods of time.

Probably the best treatment for *Vincent's angina* is to carefully wipe off the affected surface and then swab it twice daily with a solution of the contents of 1 ampoule of arsphenamine in 2 drams (8.0) of glycerin.

Administration.—Always before giving arsphenamine examine the patient in general routine as to disease of the heart, kidneys, lungs and liver as well as for far advanced arterial degeneration, as these conditions contraindicate its use or should make the physician most cautious in resorting to this drug.

Arsphenamine may be given intravenously, intramuscularly, or subcutaneously, and by the rectum. The subcutaneous method has been practically discarded. Given intramuscularly, the remedy may cause pain and may produce inflammation and sloughing, although this rarely occurs. It acts more slowly given in this way, but is less prone to cause sharp and severe general effects than if given intravenously. Nevertheless in the majority of cases the intravenous method is the one of choice. In the preparation of the drug for use it must be borne in mind that arsphenamine is a dihydrochloride of dioxy-diamido-arsenobenzol, and that when it is dissolved in water it forms a diacid solution. When so dissolved with the addition of 1 molecular proportion of sodium hydroxide, it forms a mono-acid solution. If it is dissolved in water with 2 molecular proportions of sodium hydroxide, it makes a neutral *suspension* of the free base. If 3 molecular proportions of sodium hydroxide are added it forms an alkaline *solution,* not a suspension.

All of these forms have been used. The alkaline solution is, however, the best. Before opening the ampoule it should be immersed in 95 per cent alcohol for fifteen minutes. If any opening is discovered that ampoule should be discarded. The following table may be used to indicate the proportions of arsphenamine and sodium hydroxide in 15 per cent solution used for intravenous or intramuscular use. The sodium hydroxide solution if kept for any length of time should be placed in a flask which has been coated inside by hot paraffine and a rubber stopper used to protect it from the air.

Arsphenamine.	Official 15 per cent. sodium hydroxide				
gram.	gram.	= cc	corresponding	to	drops.
0.6	1.308	= 1.14	"	"	23
0.5	1.09	= 0.95	"	"	19
0.4	0.872	= 0.76	"	"	15
0.3	0.654	= 0.57	"	"	12
0.2	0.436	= 0.38	"	"	8

The water which is to be used should be distilled in glass or block tin and immediately sterilized in an autoclave or by boiling in Erlenmeyer flasks which are to be closed by cotton stoppers, wrapped in gauze and covered with paper if the water is not to be used at once. The rubber tubing to be used should be prepared by filling it with normal sodium hydroxide solution and so treated for at least six hours, after which it is thoroughly washed out with sterile distilled water, sterilized by boiling and again rinsed as before.

Into a glass cylinder of 250 cc. capacity, with a ground-glass stopper, put from 30 to 40 cc. of cold, boiled, freshly-distilled water (for caution see Intravenous Injection, Part III), and add (0.6 gram of arsphenamine, gently shaking it out of the ampoule. Shake slightly until dissolved, and add about 1.14 cc. (23 drops) of 15 per cent sodium hydroxide solution. This forms a precipitate that redissolves. Add enough water to make 180 to 250 cc., adding a few drops of sodium hydroxide solution, if need be, to keep the solution intact. The solution must be alkaline, for most of the evil effects follow the use of a slightly acid mixture. On the other hand, the solution must not be over-alkalinized. Each 30 cc. of the 180 solution contains 0.1 gm. of arsphenamine. This is for intravenous use after it has been filtered through sterile gauze and allowed to stand for thirty minutes. Unless the solution is perfect discard it.

For intravenous injection a syringe may be used, but an apparatus such as is commonly employed for the intravenous injection of normal salt solution is much better. (See Intravenous Injection.) The injection should be given very slowly over a period of eight minutes, while the patient is lying down, through a large hollow needle (No. 16 or 18) or a small cannula, which is pushed into a vein. Care must be taken that the fluid does not escape into the perivenous tissues, as it will cause great pain and inflammation. This may be remedied by the immediate injection of a small quantity of a 5 per cent solution of sodium thiosulphate. To avoid such an accident it is best to wait for the appearance of blood in the needle before connecting the syringe or tubing or to run in some plain normal saline solution first, so as to be sure the needle is in the vein and, in order that none of the arsphenamine may remain in the needle when the injection is finished, and be set free in the tissues when the needle is withdrawn, it should be followed by a little saline solution. (See Intravenous Injection, Part III.) Usually it is best to stop the flow of the fluid after the first quarter is given to see if the patient tolerates it well.

A number of material modifications of this plan have been introduced designed to simplify the technique. Thus 0.6 gram of arsphenamine is placed in 10 cc. of sterile distilled water, then shake the mixture vigorously until complete solution takes place. When solution is absolute, add 19 drops of the 15 per cent sodium hydroxide solution which causes precipitation which redissolves on shaking. Enough sterile distilled water is now added to make up 15 cc. If the solution is not clear add 1 more drop of sodium hydroxide and shake well. If after three minutes the solution is not complete repeat this procedure. Now draw the solution into a 20 cc. Luer syringe. Attach syringe to needle, insert needle into vein and pull on piston. Expel all air from the syringe so that the appearance of blood proves that the vessel has been entered, then inject slowly over a period of several minutes. This method permits the use of syringe and avoids the ill effects sometimes induced by large injections, but if this plan is followed the injection should take fifteen or twenty minutes. Even so, this not as safe as the dilute solution, and Schamberg, so well known for his work in these lines, believes the best proportion is 20 cc. of water to each 0.1 of drug.

The use of freshly distilled sterile water as just described is generally employed but it has been shown by Kolmer that sterile saline solution is better since a solution so prepared is less prone to produce hemolysis. The strength of the saline solution must vary with the quantity of fluid used because the object sought is to inject a fluid which is isotonic with the blood and tissues. Thus, if the dose of arsphenamine is 0.6 in not less than 125 cc. it may be dissolved in sterile normal saline, or if the dose is 0.4 in 80 cc. On the other hand, if the physician wishes to use a small bulk of fluid as described above he should use a saline solution of from 0.3 to 0.5, since if normal saline of 0.9 per cent is employed the necessary addition of sodium hydroxide will make the mixture hypertonic. As all solutions of arsphenamine are somewhat hemolytic the use of such isotonic fluids as just described are advantageous since thereby we avoid the hemolysis due to hypertonic injections.

Comparatively recently E. R. Squibb & Co. has devised a practically permanent solution of arsphenamine in sealed glass containers holding 0.4 in 80 cc. and 0.6 in 120 cc. respectively. This container is directly attached to the tube and needle provided, and the injection given without the trouble of preparing the solution by the physician. For those who use the drug relatively infrequently this is the best plan.

Before arsphenamine is used by the intravenous route the patient should have the bowels well opened and have an empty stomach. He should be lying down when it is given, and the skin at the site of operation should be sterilized by 2 per cent tincture of iodine. After all injections the patient should remain recumbent for several hours.

Another method, involving the use of almond oil or olive oil, permits the injection to be given intramuscularly. Place a small amount of sterilized almond oil in a clean, dry and cool mortar and add the arsphenamine to it gradually, with active trituration with a pestle, so that the resulting mass is perfectly smooth. This mixture, when of the proper consistency to permit its use, is drawn up into a strong syringe, the barrel of which must be first wiped dry and oiled. Care must be taken that none of the drug is left in the wound made by the needle, as it may cause a slough. This can be avoided by injecting deeply and being sure that the needle is well emptied by an energetic push at the end of the injection. If possible the physician should use the sterile sealed ampoules now placed on the market containing arsphenamine suspended in fat instead of attempting to use the plan just given. For intramuscular injection a strong glass syringe and a strong needle of No. 20 gauge should be used. The area for an intramuscular injection should be 2 inches outward from the union of the folds of the buttocks. (See Salicylate of Mercury and Sulpharsphenamine.)

When intravenous injections are inadvisable or difficult arsphenamine may be given by the rectum. The drug is dissolved as described above in 100 cc. of water and the solution allowed to slowly enter the bowel. The dose should be retained as long as possible and to aid in its retention rest in bed should be insisted upon. The quantity of the drug used is commonly 0.6 gram, and if the patient is a child the dose is calculated on the basis of about 0.1 gram for each 25 pounds of body weight. The method is not as efficacious but is less dangerous than the intravenous plan.

Intravenous medication is, however, almost universally resorted to.

To attack the parasite in the cerebrospinal fluid or tissues Swift and Ellis and many others have given arsphenamine in the usual way, then drawn some of the blood from the patient's vein and injected the serum containing minute amounts of the drug and the newly-formed antibodies into the spinal fluid by spinal puncture, thereby avoiding the danger which would be present if arsphenamine was directly injected by this route. When cerebrospinal syphilis is present it would, therefore, seem good practice, particularly in *locomotor ataxia* and *paresis,* to give an intravenous dose of arsphenamine or neo-arsphenamine. An hour later about 40 cc. of blood are taken from the arm, allowed to coagulate, and centrifugalized. The next day 12 cc. of the serum are diluted with 16 cc. of normal saline solution and heated to 56° C. for one-half hour, since this heating has been found to increase its parasiticidal properties. Lumbar puncture is now performed and cerebrospinal fluid withdrawn until the manometer shows the pressure to be about 30 mm. of water. The barrel of a good-sized syringe is attached to the needle, which has been left *in situ*, by means of 40 cm. of rubber tubing, and the tubing is allowed to fill with cerebrospinal fluid up to the syringe, thereby driving out all air. When the tube is filled up to the barrel of the syringe the barrel is filled with the serum already prepared, and by slowly and gently elevating the tube and barrel the fluid enters the subarachnoid space. The dose of arsphenamine is usually 0.45 to 0.5 every two weeks until the Wassermann test when applied to the spinal fluid is negative. In certain cases of locomotor ataxia this injection may cause some pain in the legs, which is usually relieved by codeine or morphine. Too much cannot be expected from this plan, for destroyed tissues cannot be renewed. When the spirochete are living in the cerebrospinal tissues great improvement may ensue from this treatment in the early stages of tabes, but to a much less degree in paresis. When evidence of infection of the brain or its membranes is marked it is best to precede this treatment by active mercurial medication, since by this means the danger of Herxheimer's reaction is decreased. (See Untoward Effects.) It is not sufficient to rely upon the Wassermann reaction in the blood, as it may be negative at a time when the cerebrospinal fluid will give a positive reaction. Furthermore, the Wassermann test of this fluid may be negative yet the colloidal-gold test may be positive.

The best plan if arsphenamine is to be used for an effect by intraspinal injection is to take 1 cc. of the solution if the total amount to be given intravenously is 200 cc. and lay it aside in a sterile test-tube while the intravenous injection is administered. As soon as this is accomplished 25 cc. of blood are taken from another vein by means of a sterile syringe and placed in a centrifuge tube of a capacity of 50 cc. and containing 4 cc. of a sterile 10 per cent solution of sodium citrate in normal salt solution. The blood and solution are gently stirred to prevent clotting and then centrifuged for twenty or more minutes. To the clear plasma, even if colored by hemoglobin, 1 cc. of the arsphenamine solution above named is added and this serum, arsphenaminized *in vivo* and *in vitro*, is used as for intraspinal injection after it has been put in a water-bath at 56° C. (132.8° F.) for thirty minutes (Kolmer's method).

I have retained the above paragraphs in this edition because a large number of practitioners still have faith in the methods therein described, but from my own experience, and that of my colleague, Dercum, I am about satisfied that any benefit which accrues is largely due to the draining off of the cerebrospinal and not to the injection of the serum. That arsenic enters the cerebrospinal fluid after intravenous injection is certain. Thus Cornwell and Myers have shown that two hours after an average dose it may be present in as large an amount as 143 milligrams per cent of dried fluid, and seventy-two hours after the dose the quantity may be 192 milligrams per cent. Further, I have seen the injections precipitate severe gastro-intestinal crises. The flow of fluid is not from the arachnoid space outward, but inward, and therefore the arsenic passes from the vessels into the cerebrospinal fluid, particularly if the pressure is lessened by drainage. Furthermore, syphilitic patients rarely have headache after simple drainage, whereas severe headache often follows the use of arsphenaminized serum.

Still another plan is that of Corbus and others. It having been found that the intravenous injection of hypertonic salt solution results in a great absorption of cerebrospinal fluid, these clinicians inject 100 cc. of 15 per cent sodium chloride solution at about 10 A.M. and at about 4 P.M. when the salt has been eliminated they give arsphenamine intravenously with the idea that the drug will be taken with the new fluid into the subarachnoid space. Such strong salt solution may cause some hemolysis.

The active use of mercury and iodides is also essential in all cases. (See Syphilis.)

The mere presence of a positive Wassermann reaction in the spinal fluid is not in itself an indication for intraspinal treatment, unless symptoms of neurosyphilis are beginning. Indeed, the injection may, as already indicated, flare up lesions which are so latent as to be harmless and such an injection may change a plus 2 to a plus 4, indicating that more poison has been set free and that the changes in the nervous system have been, at least for a time, exacerbated.

Untoward Effects.—The untoward or evil effects which occasionally occur may develop during, immediately after, a few hours after, or many days after the use of this drug by the vein. The immediate symptoms may be a sense of faintness or actual syncope, or instead there may be flushing of the face followed by puffiness with swelling of the lips and tongue. There may be also dilated pupils, tachycardia, cyanosis, dyspnea and sometimes a sense of precordial distress. Generally these symptoms last only a short time, but they may persist for some hours and, although the symptoms seem alarming, the patient in the great majority of instances recovers rapidly. To this chain of symptoms the term "nitritoid" or "anaphylactoid" crisis is applied. In other cases in from two to twenty-four hours the patient suffers from a chill, headache and fever, which symptoms may persist for a day. The later manifestations consist in albuminuria with bile in the urine or even anuria. Occasionally a persistent jaundice develops some days or even weeks after a series of injections and may last a long time. Rarely the patient dies as if suffering from acute yellow atrophy of the liver. Care should be taken to separate arsphenamine jaundice from an incidental catarrhal jaundice. In the former fever is rare and the liver is not enlarged and tender as in catarrhal jaundice. An important point is that in arsphenamine jaundice there is a slight leukocytosis and a normal differential count, whereas in catarrhal jaundice there is a leukopenia and an excess of lymphocytes (Lerman.)

It is becoming more and more evident that the liver is the organ which suffers most from this drug, particularly if the patient has been deprived of carbohydrate food, and this is true even if jaundice never appears.

The most grave untoward effects are cerebral. They may come on almost at once after a second or third dose and may soon end in death. The patient feels apprehensive and nervous. Severe headache, vomiting and dyspnea may develop, unconsciousness ensues, the teeth are clenched, convulsions develop, a sharp rise of temperature occurs and the end comes in a few hours. An autopsy will reveal a hemorrhagic encephalitis.

Fraser and Duncan found that death followed the use of arsphenamine at the rate of 1 in 13,000, after sodium arsphenamine 1 in 20,000 and after neo-arsphenamine only 1 in 162,000, but Phelps of the Medical Corps, U. S. Navy, reports upon 191,778 doses of the arsphenamine and found undesirable reactions in the proportion of 1 to 683 from arsphenamine and of 1 to 1109 with neo-arsphenamine.

Not rarely after an injection the skin lesions become darkened for a brief time. This is called a "Herxheimer reaction."

A preliminary subcutaneous injection of 10 to 15 minims (0.65–1.0) of adrenalin chloride, 1 to 1000, will often act as an efficient prophylactic for the milder untoward effects. It is also the best remedy for the nitritoid crisis. A preliminary dose of atropine is also useful. Should the patient present evidences of cerebral trouble his chance lies in its early recognition and the active use of adrenalin with oxygen inhalations, lumbar puncture to relieve cerebral pressure, and venesection if there is venous engorgement. It would appear probable that the intravenous use of sodium thiosulphate may do good.

It is hardly necessary to add that should any untoward effect be manifest as the injection is given it should be instantly stopped.

Skin eruptions following a treatment indicate great caution as to additional doses. Ehrlich pointed out that to repeat the dose within four or five days in such instances is equivalent to pouring oil on a fire and may cause the death of the patient, and if a marked dermatitis develops Fordyce insists that it is very dangerous to repeat the dose within six months or a year.

Ehrlich believed that in delayed toxic cases the symptoms may be due to an oxidation product of arsphenamine, paraminophenylarsenoxide.

In 127,000 patients receiving this drug intravenously in three different clinics the occurrence of a dermatitis was 1748. Such a dermatitis is best treated by the oral and intravenous use of sodium thiosulphate. The intravenous dose is at twenty-four-hour intervals for three or four days, and equals about 5 grains (0.37). After this, at forty-eight-hour intervals, from 7 to 10 grains (0.4–0.65) are used. (See Sodium Thiosulphate.)

Contraindications.—Arsphenamine is contraindicated in advanced degenerative lesions of the nervous system or kidneys, in advanced tuberculosis, when there is disease of the nervous portion of the auditory apparatus, and in persons who have a marked idiosyncrasy to arsenic. Any definite disorder of the liver is also a contraindication.

Arsphenamine must be used with the greatest caution, or not at all, in the presence of marked myocarditis. So, too, in acute cerebral syphilis it must be used with care lest it produce an acute exacerbation by intensifying the inflammatory process already present. It is contraindicated in syphilitic cirrhosis but probably not in gumma of the liver. Such cases should first receive a thorough course of mercury and iodides. (See Untoward Effects.) Addison's disease contraindicates this drug, as does also status lymphaticus.

Because of its easy administration, neoarsphenamine has largely supplanted the older drug (see Neoarsphenamine), but this remedy is not as efficient or active as arsphenamine. (See also Silver Arsphenamine and Sulpharsphenamine.)

ASAFŒTIDA.

Asafœtida, U. S., *Asafetida*, B. P., is a gum resin. Its odor is penetrating and strong, and resembles that of garlic. When taken internally it causes a sensation of warmth and acts as a stimulant and carminative in the alimentary canal.

Therapeutics.—Asafœtida is used in medicine as a *carminative* which will particularly affect the lower bowel, and is useful in the *intestinal indigestion* of old persons when associated with *flatulence*, and in the flatulent *colic of children.* In the form of rectal injections it is of value for relief of the *tympanites* of children and in that of adults during *typhoid fever* and *pneumonia.* It is also used as a stimulating expectorant in the later stages of *bronchitis.* In the nervous irritability of children it is often of service.

Administration.—Asafœtida is given in pills of asafœtida (*Pilulæ Asafœtidæ*, U. S.), of which 2 or 3 may be taken, each one containing 3 grains (0.2); the emulsion or milk of asafœtida (*Emulsum Asafœtidæ*, U. S.), the dose of which is ½ to 1 ounce (16.0–30.0); and the tincture (*Tinctura Asafœtidæ*, U. S. and B. P.), ½ to 1 fluidram (2.0–4.0). The suppositories at one time official contained the equivalent of 40 drops (2.6) of the tincture. The plaster of asafœtida (*Emplastrum Asafœtida*) is used where a mild counterirritant and antispasmodic is needed. When *intestinal indigestion* and *flatulence* occur in old people, the following pill is of service:

℞—Extracti nucis vomicæ	gr. v (0.3)
Pulveris capsici	gr. xx (1.3)
Asafœtidæ	gr. xl (2.6).—M.

Fiant pilulæ No. xx.
S.—One night and morning.

A B. P. preparation, not official in the U. S. P., is *Pilula Galbani Composita*, composed of asafœtida, galbanum, and myrrh; dose 4 to 8 grains (0.24–0.48).

ASPIDIUM.

Aspidium, U. S., *Filix-mas*, B. P., or Male Fern, is employed in medicine as a tæniacide or remedy for the *tapeworm*, and is a very efficient and valuable drug under such circumstances, being, perhaps, the most reliable of all the tæniafuges except pelletierin. When employed, the directions and precautions given in the article on Worms (Part IV) must be strictly followed. It is also a valuable remedy in *uncinariasis*.

Male fern taken in overdose is capable of producing poisoning, and when taken in such a dose causes, according to Quivill, irritation of the gastro-intestinal mucous membrane and diarrhea. If absorbed, it acts on the central nervous system and causes paralysis, collapse, and death. The form and manner by which it is eliminated are unknown. It may in overdose cause albuminuria and glycosuria, and a number of cases of jaundice have been recorded which Hanssen asserts is not due to hemolysis, but its action on the liver. To give more than 1½ drams (6.0) of the oleoresin at a dose is dangerous.

Administration.—Male fern is rarely, if ever, used at present in its crude form, being employed most commonly in the United States in the form of the oleoresin (*Oleoresina Aspidii*, U. S.); dose ½ to 1 fluidram (2.0–4.0) in capsule, or as follows:

℞—Oleoresinæ aspidii,		
Tincturæ vanillæ	āā	♏xlv (3.0)
Pulveris acaciæ		ʒss (2.0)
Aquæ destillatæ		f℥j (30.0).—M.

S.—Take entire amount after fasting, and follow in two hours by a full dose of sulphate of magnesium.

The dose of the liquid extract (*Extractum Filicis Liquidum*) of the B. P. is 45 to 90 minims (2.7–5.4).

Katamaya and Okamoto, two Japanese investigators, and Poulssen, state that castor and other oils should not be used after filix-mas is given, as oils increase the absorption of the active principle, and so predispose to the development of poisoning.

BALSAM OF PERU.

Balsamum Peruvianum, U. S., and B. P., has been employed internally as a stimulating expectorant. Externally it is commonly used in healing salves. One dram (4.0) of balsam to 7 (28.0) of simple cerate is useful in the healing of cracked nipples and indolent ulcers. Mixed with vaseline and rubbed over the hands it prevents disagreeable odors remaining on the skin after treating ulcerative surfaces or making postmortem examinations. Applied over a large area of the body as a remedy for scabies it may cause acute nephritis.

BARBITAL AND BARBITAL SODIUM.[1]

Barbitalum, U. S., German name *Veronal* (*Barbitonum,* B. P.) it is compound of urea, its chemical name being diethylmalonylurea, or diethylbarbituric acid. It occurs in fine white crystalline powder, which is odorless, and has a faintly bitter taste. Barbital is soluble in 145 parts of water, and for this reason is always given in capsule or cachet. Its action is allied to that of trional and it is said to have no effect upon the blood or respiration.

It is used to *produce sleep,* to a limited extent as a pain reliever and is commonly given in capsule in the dose of from 5 to 10 grains (0.3–0.6) taken one-half hour before retiring for the night. The drug is very slowly eliminated, and should not be given continuously for more than two weeks. Because of its slow elimination it is usually contraindicated in nephritis of all kinds and the infectious diseases. When given for a long period the bowels must be kept freely open and alkalies administered. It is a most satisfactory hypnotic in *nervous insomnia* and is singularly free from after-effects if it is given early enough in the evening for its effects to wear off before the patient wishes to be active the next day. When taken in full dose it will often cause ataxia, hallucinations and tremor, and when used for a long time mental depression, suicidal tendencies, or the symptoms of general paresis may develop. All the barbituric acid drugs are prone to cause widely variant eruptions on the skin.

Very large doses of barbital are necessary to produce death, probably more than 150 grains, but 10 grains are said to have caused death. When a poisonous dose is taken sleep lasts about two or three days, and rarely sleep lasts for ten days. The heart and respiration act normally in the mild cases, and pupillary reactions are maintained. When a lethal dose is ingested the action of the heart and respiration become irregular, Cheyne-Stokes breathing develops and cyanosis ensues, followed by death, usually not for at least twenty-four hours.

Under the name *Barbitalum Solubile* (U. S.), German name

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[1] As veronal and medinal are familiar terms, reference is made to them at first impulse, but physicians should use the American terms barbital and barbital sodium, as by so doing they use American-made drugs.

Medinal, a soluble sodium salt (1 to 5 of water) of barbital has been introduced, which can be given in solution by the mouth or rectum. When used hypodermically 7 grains (0.5) are dissolved in 75 minims (5.0) of distilled water. The dose is the same as that of barbital. Barbital sodium also acts more rapidly when given by the mouth than does barbital because it is soluble. It is best administered in tablet form or in hot sweetened water. Barbital sodium is a useful prophylactic, given by the mouth, when excessive effects of cocaine are feared, or as a remedy if evil symptoms follow the use of cocaine, when it should be given hypodermically or even intravenously, 3 to 5 grains (0.22–0.3) in 20 to 30 minims (1.3–2.0) of normal saline, as it seems to have a specific effect. Under the name "Peralga" a tablet of barbital and amidopyrine is sometimes used as an efficient pain reliever. (See Allonal, Dial and Phenobarbital.)

BELLADONNA.

Belladonna is botanically known as *Atropa Belladonna,* and is official in the form of the root (*Belladonnæ Radix,* U. S. and B. P.) and leaves (*Belladonnæ Folia,* U. S. and B. P.). Its popular name is "deadly night-shade." The drug belongs to a very large class of plants, namely, the *Solanaceæ,* all of which have a similar physiological action. Belladonna contains an active principle in the form of an alkaloid known as atropine (*Atropina,* U. S. and B. P.), which is insoluble in water. Atropine possesses a bitter acrid taste (it should be tasted with the utmost caution and only in dilute solution). The sulphate of atropine (*Atropine Sulphas,* U. S. and B. P.) is very soluble, and is the salt commonly used.

Physiological Effects.—In man, full medicinal doses produce flushing of the face, redness and dryness of the fauces, dilated pupils, sometimes an erythematous rash over the skin, rarely diplopia and delirium. If the dose be still larger, the delirium becomes marked, and is wild and talkative. The pulse is rapid and wiry. The rash which appears resembles that of scarlet fever, but lacks the punctuations. The skin may desquamate after the lapse of several days if the rash is severe.

In children belladonna is usually borne very well. When the action of belladonna asserts itself in children and in susceptible adults the respiration is quickened, the eyes become bright and the cheeks red, but lines of pallor reach from the malar bones to the angles of the mouth, giving to the face a curious expression.

ABSORPTION.—This drug is very rapidly absorbed.

NERVOUS SYSTEM.—Belladonna when given in medicinal amount approaching the toxic dose acts as a powerful excitant of the brain, producing talkative delirium. Locally applied, it depresses the peripheral sensory nerves.

In large medicinal dose belladonna may be considered as a depressant to the motor nerves and as a quieter to sensory nerve filaments. On voluntary muscles the drug has no effect, but upon unstriped muscles it acts as a sedative and antispasmodic. It distinctly lessens reflex action.

Circulation.—Belladonna quickens the pulse by depression of the peripheral vagi and by stimulating the cardiac muscle and the accelerator nerves. It has been thought that atropine causes a rise of arterial pressure, but recent investigation has thrown doubt upon this view. That the drug acts as a powerful agent upon the vascular system is certain. It dilates the bloodvessels of the skin, but contracts the vessels of the splanchnic area, and this is why it is so valuable in collapse and shock, since relaxation of the splanchnic vessels is the dominant vascular state in these conditions. In other words, it restores circulatory equilibrium. The dilatation of the capillaries of the skin is in part the cause of scarlet-red skin of belladonna poisoning.

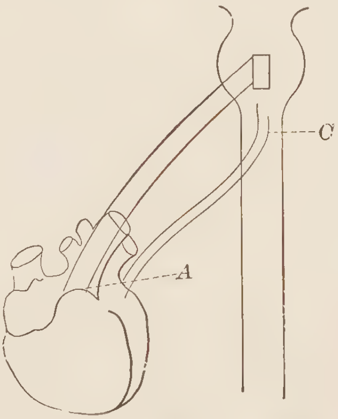

Fig. 14.—*A*, atropine depresses the peripheral vagi and stimulates the accelerator nerves (*C*).

In poisonous doses it causes a fall of arterial pressure due to centric vasomotor palsy and depression of the muscular coats of the bloodvessels, but there is no direct cardiac depression, as has been generally taught, for Reichert has proved that the drug is not a heart-depressant unless the dose is simply overwhelming. Sometimes when belladonna is given the pulse becomes slow, but in these cases the slowing is due to temporary stimulation of the peripheral vagi or to momentary depression of the cardiac motor ganglia. (See Figs. 14 and 15.)

Respiration.—Atropine is a stimulant to the respiratory center in ordinary amounts, but recent careful studies show that its high reputation as a respiratory stimulant is not based either on clinical or experimental evidence. In many cases it fails to increase the respirations at all, and it is certainly inferior to caffeine and strychnine in the treatment of opium poisoning. In large doses it is a depressant and paralyzant to respiration, and produces death from respiratory failure due to paralysis of the motor nerves supplying the respiratory muscles, and probably by depressing the respiratory center.

Abdominal Viscera.—Balladonna increases peristalsis by depressing the peripheral ends of the inhibitory fibers of the splanchnic nerves, and by diminishing any tendency to spasm on the part of the muscular coats of the intestine. The splanchnic effect has been denied.

Action on Secretion.—The drug decreases all the secretions of the body except the urine, which is sometimes increased in amount under its use. The decrease of secretion is due to depression of the peripheral nerve-filaments supplying the secretory cells of the glands.

Bodily Heat.—When belladonna is used in large amounts there is nearly always a rise of temperature, which in children may amount to one or two degrees. This is probably due to stimulation of the thermogenic center in the corpus striatum. In advanced poisoning the temperature rapidly falls.

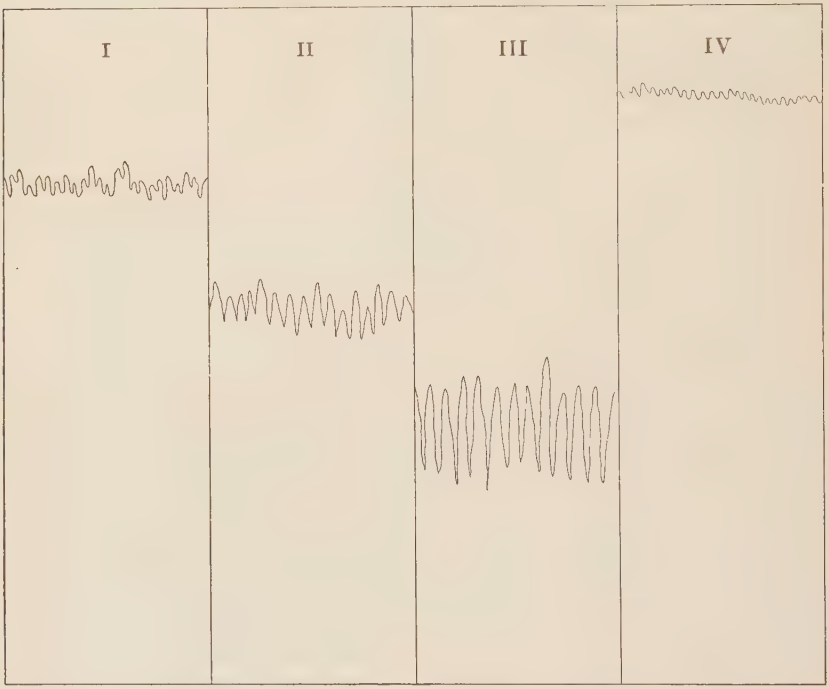

Fig. 15.—Tracing showing the effect of atropine as a vasomotor stimulant (after Schmiedeberg): *I*, normal tracing of pressure (126) and pulse 28 in ten seconds; *II*, pressure lowered by pilocarpine to 96, pulse 19; *III*, tracing continued, pressure 70; *IV*, atropine has been given, raising the pressure to 145, pulse 30 in ten seconds.

Elimination.—Atropine is eliminated by the kidneys and bowels with extraordinary rapidity, and this is one of the reasons why death from poisonous doses of the drug is so rare. J. Harley asserts that it is entirely eliminated in two hours, and Meuriot states that not a trace of it can be found after twenty-four hours, and that it is partly destroyed in the liver. In a case of suspected poisoning the urine of the patient may be dropped into the eye of an animal, when, if atropine or belladonna has been taken, mydriasis will result.

Eye.—On the eye belladonna produces dilatation of the pupil in part by a depressant action on the endings of the oculomotor nerve in the iris, by causing a paralysis of the circular muscle fibers in the iris and perhaps by a stimulant effect on the peripheral sympathetic nerve fibers. The dominant action of the drug is undoubtedly the depression of the circular muscular fibers of the iris. Associated with mydriasis there is also paralysis of accommodation due to the paralysis of the ciliary muscles by the effect of the drug on the oculomotor nerve. Belladonna generally increases intraocular tension.

Poisoning.—Poisoning by atropine is an exceedingly common occurrence, but death is rarely produced by it, partly because its influence is not very actively exercised on vital parts, and partly because it is eliminated by the kidneys almost as rapidly as it is absorbed from the stomach. Recovery has occurred after as much as 1 grain of atropine has been taken by a child of three years. Aside from the symptoms of mild poisoning detailed under the heading of physiological action, severe poisoning is characterized by deep sleep, preceded, it may be, by convulsions, violent delirium, blindness, and sometimes loss of speech.

Treatment of Poisoning.—Poisoning by belladonna is to be treated by emetics, the application of external heat if the patient passes into collapse, and the use of strychnine if respiration fails. Opium may be employed in carefully graded doses as the physiological antagonist; but large doses are of doubtful service, particularly if the respirations are not in a satisfactory state.

Therapeutics.—Belladonna is used to allay *excessive secretion*, to act as an *antispasmodic*, and to influence the circulatory apparatus when *local inflammations* are beginning, particularly in secretory glands, and to act as a vascular tonic (Fig. 15). In *cardiac palpitation* small doses of belladonna internally, or its external use over the precordium in the form of the plaster or ointment, is very valuable.

For the relief of local *nerve pains* it is of value, and probably acts by quieting the irritated nerve. It should be applied in these cases in the form of an ointment or plaster, and if the ointment is used it should be well rubbed into the part affected.

To check secretion in *night-sweats* it is one of the most powerful remedies we have, and it is useful in excessive *idiopathic ptyalism*, as seen in children, or in that due to mercurialization. In *bromidrosis of the feet* and other localized sweatings it is useful, and may be employed locally or taken internally for their cure. It is the most efficacious drug we have for *checking the secretion of milk* in an inflamed breast, and under these circumstances it is to be smeared over the gland in an ointment. Belladonna may be used in *serous diarrhea*, as it checks the disorder by stimulation of the splanchnic filaments of the intestinal bloodvessels, which being inactive permit a transudation of liquid into the bowel.

Trousseau recommended as a local remedy 1 to 2 grains (0.06-

0.12) of the extract of belladonna with 6 to 8 grains (0.4–0.5) of tannic acid in *leucorrhea* dependent upon disease of the uterine cervix. This should be placed on a pledget of cotton and applied to the affected part daily, being allowed to remain all day. Ringer states that if pain is also present in these cases the following injection is of value.

℞—Sodii bicarbonatis	ʒj (4.0)
Tincturæ belladonnæ foliorum	fʒiij (12.0)
Aquæ destillatæ	q. s. ad Oj (480 cc.).—M.

This is to be injected into the vagina, the woman first being placed on the back with the buttocks raised, so that the drug may bathe the uterine cervix for some minutes.

As an antispasmodic, atropine is to be used in *acute torticollis*, injected directly into the muscle itself so as to act on its motor nerve-fibers; it may be given in *spasm of the intestines* with *cramps* and *griping*. In *cramps in the legs and body*, either as a local application by means of liniments or when employed internally, it is of service. In *asthma* of the spasmodic type atropine is a sovereign remedy, particularly if it be combined with morphine. It may be used both as a prophylactic and as a cure during the attack. Belladonna leaves may be smoked by asthmatics by rolling them into a cigarette or putting them into a pipe.

This drug is used in *whooping cough* at all ages and in all stages, but it must be given in large amounts and is only a palliative.

In *spasm of the sphincter ani*, whether it be due to *fissure* or other cause, belladonna in the form of an ointment or suppository is of value. In *spasm of the urethra and bladder* the drug may be used internally and externally, and in the former state the ointment should be smeared along the under surface of the penis every night. This treatment is also useful in *chordee*. In the *colic* resulting from the passage of *hepatic and renal calculi* atropine in full dose by the hypodermic needle combined with morphine will very often give relief. Where *urinary incontinence* depends upon spasm of the bladder belladonna should be used. (See Incontinence of Urine.) In *dysmenorrhea* in nervous women, with spasm of the cervix uteri, it is of value applied as an ointment or in a vaginal suppository, or when given by the mouth. For the *nervous cough of children* and adults belladonna is one of the best remedies we have. In *constipation* it does good by depressing the inhibitory nerves of the intestine. It is also of value in *laryngismus stridulus* and in hiccough. In children who suffer from what has been called *hypertonia*, a state characterized by irregular attacks of vomiting with visible peristalsis, constipation of the spastic type, muscular irritability and insomnia, atropine will often act as a specific. If improvement does not follow its use after a few doses the case is probably not one of hypertonia. Full doses of atropine hypodermically are often of great value in so-called *pyloric stenosis* in infants dependent upon spasm of the pylorus.

In *iritis* atropine is used to dilate the pupil and prevent adhesions. The solution to be dropped into the eye should contain 1 to 4 grains (0.06–0.25) of atropine sulphate to the ounce (30.0) of water. (See Iritis.) Atropine sulphate is also used for the purpose of producing *mydriasis* before ophthalmoscopic examination, in solutions of the strength just given. It increases intra-ocular tension and is contra-indicated in glaucoma. (See Glaucoma and Iritis, Part IV.)

When employed to act on the circulation, it is to be used in *shock* and *collapse* from injury or in the course of severe disease. (See Shock.) During the progress of a case of *pneumonia, typhoid fever,* or other severe disease belladonna should be kept in the house, and administered freely if collapse or relaxation of the splanchnic vessels suddenly asserts itself. Particularly is this true in the case of *pneumonia.* The vascular system during the crisis of this disease will often be found much relaxed, and heart stimulants do not seem to do much good. The administration of atropine or belladonna will dry the leaking skin, and by increasing the vascular tone produce great improvement. A large dose of atropine, given hypodermically, is the best remedy we have in *pulmonary edema,* and for the relief of the symptoms of *anaphylaxis* after the use of antitoxin. The hypodermic use of atropine before administering chloroform greatly increases the safety of this anesthetic, because it stabilizes vascular tonus and prevents loss of heat from the skin by sweating. (See also SCOPOLAMINE.)

In *mastitis,* or inflammation of the breast, belladonna, if pushed, will give surprisingly good results if given internally and applied locally. In *acute sore-throat,* when there is a sensation of rawness in the pharynx, while the local capillaries appear injected and red, belladonna is often of the greatest service if given in full dose, aborting the "cold."

In *exophthalmic goiter* belladonna certainly gives relief in some cases, particularly if combined with strophanthus or digitalis.

In *headache* occurring in young persons, often due to *ocular overwork,* with pain in the eyeballs and forehead and a sensation as if the orbits were too small for the eyeballs, belladonna is of service. In *intercostal neuralgia* or *pleurodynia* a belladonna plaster may be applied to the spot where the pain is felt, with relief.

Use of Atropine in Poisoning.—Atropine is a physiological antidote to opium, Calabar bean or physostigma, and jaborandi. In opium poisoning it acts as an antidote in all parts of the body except the eye, and in jaborandi poisoning the same holds true; but in the former condition, although it has been largely used, it is no longer regarded as a satisfactory antidote; caffeine and strychnine are preferable. The condition of the pupil is not a guide as to the effect of atropine in opium poisoning, because opium acts centrically and atropine acts peripherally on the nerves governing the iris. Atropine should be used in aconite, antimony, and hydrocyanic acid poisoning for its stimulating influence on the vasomotor system, the respiratory center, and the heart, and for the purpose of maintaining the bodily heat, the dissipation of which it retards by preventing vasomotor palsy and consequent dilatation of the peripheral bloodvessels.

Atropine is a valuable physiological antidote to poisonous mushrooms, particularly the *Amanita,* as it is antagonistic to their poison, muscarine. The dose given should be large, and, if need be, repeated.

Administration.—The dose of the sulphate of atropine (*Atropinæ Sulphas,* U. S. and B. P.) is $\frac{1}{250}$ to $\frac{1}{40}$ grain (0.0002–0.0015). The alcoholic extract (*Extractum Belladonnæ,* U. S.; *Extractum Belladonnæ Siccum,* B. P.) is given in $\frac{1}{6}$ to $\frac{1}{4}$ grain (0.01–0.015) doses, and the tincture (*Tincture Belladonnæ,* U. S.; *Tinctura Belladonnæ,* B. P.) in the dose of 5 to 40 minims (0.3–2.6), 5–15 minims (0.3–1.0), B. P. Both these preparations are derived from the leaves. The fluidextract (*Fluidextractum Belladonnæ Foliorum,* U. S.) is given in 1- to 2-minim (0.06–0.12) doses, but *Extractum Belladonnæ Liquidum* (B. P.) is given in $\frac{1}{4}$- to 1-minim (0.015 0.006) doses. Belladonna liniment (*Linimentum Belladonnæ,* N. F. and B. P.), belladonna plaster (*Emplastrum Belladonnæ,* U. S. and B. P.), the ointment (*Unguentum Belladonnæ,* U. S. and B. P.) are for external application and are very useful preparations. The preparations of the B. P. not official in the U. S. P. are *Liquor Atropinæ Sulphatis,* dropped in the eyes in the dose of $\frac{1}{2}$ to 1 minim (0.03–0.06); *Lamellæ Atropinæ,* each of which contain $\frac{1}{5000}$ grain of atropine; and *Unguentum Atropinæ* and *Extractum Belladonnæ Alcoholicum,* derived from the root. *Succus Belladonnæ,* B. P., is given in 5- to 15-minims (0.3–1.0) doses. There is also official in the B. P. a suppository (*Suppositoria Belladonnæ*) which contains 1½ grains of the extract.

Contraindications.—Belladonna decreases salivary and gastric secretion very considerably in some persons. It is better, therefore, not to administer it just before or immediately after a meal, unless it is desired to reduce gastric secretion.

BENZOIN AND BENZOIC ACID.

Physiological Action.—Benzoin (*Benzoinum,* U. S. and B. P.), locally applied in concentrated form, is an irritant, and taken internally in excessive amount it causes a sensation of warmth and burning. It is eliminated as hippuric acid and increases the acidity of the urine. It is an antiseptic and germicide. In persons having an idiosyncrasy to benzoic acid it is not uncommon for urticaria to follow the use of the drug. Sometimes a papular or erythematous eruption appears after its use. The action of this drug in the system is closely allied to that of salicylic acid, in that it increases metabolic changes in the tissues. It also decreases putrefactive changes in the intestine.

Therapeutics.—Benzoic acid is useful in the treatment of *chronic cystitis* with alkaline urine which is loaded with phosphates, and combined with cannabis, acts well in the later stages of *gonorrhea.* Senator states that in the dose of 2 or 3 drachms (8.0–12.0) a day it is a specific in *acute rheumatism,* and thinks it equal to salicylic acid. When these doses are to be used, the benzoate of sodium should be employed, owing to its solubility. In *acute laryngitis* accompanied by great hoarseness the inhalation of steam laden with compound tincture of benzoin is of the greatest service. A tablespoonful (15.0) of this tincture should be placed in a pitcher of boiling water, the face held over the liquid, and a towel thrown over the head of the patient to retain the steam. The drug cannot be used in an atomizer, as it clogs the "tips." Taken internally, benzoic acid is useful as an expectorant in *chronic bronchitis* in the dose of 10 grains (0.6) three times a day.

Administration.—The dose of benzoic acid (*Acidum Benzoicum,* U. S. and B. P.) is usually 10 to 40 grains (0.6–2.6), 5–15 grains (0.3–1.0), B. P., but a dram may be given in capsules. The balsam itself is never used as such. The tincture (*Tinctura Benzoini,* U. S.) is given in 30-minim to 1-dram (2.0–4.0) doses, and the compound tincture (*Tinctura Benzoini Composita,* U. S. and B. P.), composed of benzoin, purified aloes, storax, balsam of Tolu, and alcohol, the dose of it being 1 to 2 fluidrams (4.0–8.0). The preparations official in the B. P., but not in the U. S. P., are the troche (*Trochiscus Acidi Benzoici*) and *Unguentum Cetacei.*

Adeps Benzoinatus (U. S.) and *Adeps Benzoatus* (B. P.), or benzoated lard, is a non-rancid basis for many ointments, notably that of zinc.

BETANAPHTHOL.

Betanaphthol, U. S., or *Naphthol,* B. P., is used externally in antiseptic dressings. Internally it is an excellent remedy for *gastric fermentation* and *flatulence,* as it acts as an active antiseptic. It is also useful in *fetid diarrhea* of the serous type, and is valuable in *uncinariasis.* The dose is 2 to 5 grains (0.12–0.3) in capsule or cachet. The drug is useful as a local parasiticide.

Betanaphthol-bismuth (*Bismuthi Betanaphtholas*), or *Orphol,* is a neutral, odorless and tasteless powder designed to combine the sedative effects of bismuth with the antiseptic properties of betanaphthol. It is used in cases of *serous* and *fermentative diarrhea* in adults in the dose of 5 to 15 grains (0.3–1.0) and in children in the dose of 2 to 5 grains (0.12–0.3) given every few hours in capsule.

Benzonaphthol is used as a substitute for betanaphthol in *fermentative dyspepsia.* The dose is about 10 grains (0.6) three times a day, and it is best given in cachet.

BISMUTH.

Bismuth is employed in several forms or salts as follows, and is a valuable remedy. For many years bismuth was employed, usually in an insoluble form, as an *astringent sedative* to mucous membranes, taken internally or locally applied. Within the past decade several new compounds containing bismuth have been introduced for the purpose of treating the late manifestations of *syphilis*. At present, therefore, it may be said that the subnitrate and subcarbonate are used as heretofore, and the newer ones in the treatment of syphilis, are divisible into two classes, the soluble and insoluble. Some clinicians use the soluble, hoping for rapid absorption, others prefer the insoluble, because they wish to form deposits, or reservoirs, from which the medicament will be gradually absorbed. It must be remembered that the fact that a given bismuth preparation is water-soluble is not a proof that when it is injected it will not be precipitated in the tissues, because it is tissue-insoluble, and if this is the case it is little better than a insoluble preparation, or one held in an oil suspension because it will act as an irritant and will be partly encapsulated and slowly absorbed. The tartrates are insoluble in the tissues. The salicylate is also but is not so irritating and is more rapidly absorbed, for though it is water-insoluble and tissue-insoluble the faintly acid reaction induced in the tissues aids in its absorption. This acid reaction, however, precipitates the tartrates. Clinically the use of the roentgen-rays will show at the end of some days that the bismuth salicylate is absorbed, whereas a longer period elapses before such absorption of the tartrate occurs.

The bismuth preparations used for syphilis are given intramuscularly or epifascially and not by the vein.

As it is dangerous to inject a vein after puncture is made slight suction should be made to see if blood appears. If it does the needle is in a vein, and another puncture must be made. If no blood appears the injection is given. The ordinary case receives the injection about every seven days and the course of treatment extends over 10 to 12 treatments, and is not repeated for at least a month. Great care to maintain cleanliness of the mouth is essential. If a blue line on the gum appears the treatment must be stopped at once, for if not stomatitis develops without the salivation characteristic of mercury overdosage. (For treatment see Sodium Thiosulphate.) Because of the resemblance between the mouth lesions of bismuth and mercury those drugs may not be used alternately. In another words, if active treatment is needed neoarsphenamine should be employed between the courses of these two substances, but some syphilographers, notably Stokes, deny this and believe that such alternation is of value. In any event, bismuth and mercury should not be used together, as it throws too great a strain on the kidneys. The insoluble preparations when given intramuscularly are very slowly eliminated, about one-fifth of the dose in five days (Milian and Curry). There is, therefore, an inevitable cumulative effect if they are given often. The soluble preparations of bismuth are eliminated far more rapidly than the insoluble, the elimination beginning in five or six hours.

Bismuth in syphilis is less active than neoarsphenamine. In general terms the relative therapeutic value is arsphenamine 1, bismuth 7 and mercury 4. Cases of neurosyphilis, not including paresis, are usually benefited by bismuth. (See Tryparsamide.) This is true particularly in those patients in whom arsenic and mercury has failed. Some cases do better when treated with arsenic and bismuth than if treated by either drug alone. Its chief field of usefulness appears to be the cases which do not tolerate arsenical preparations or which fail to respond to such medication, or which manifest old lesions. So too in cardiovascular disease when arsenic is too active it may be well employed. Acute or degenerative nephritis contraindicates this use of bismuth.

Anwyl-Davies of the Venereal Disease Department of St. Thomas' Hospital, London, gives the following summary of his views of the position of bismuth as an antisyphilitic remedy: "(1) Bismuth and its compounds have a definite use in the treatment of syphilis. (2) The soluble compounds are painful and more toxic than the insoluble drugs, which are painless. (3) Metallic bismuth is the least toxic of these preparations. (4) The most satisfactory method of administration is by the deep subcutaneous route. (5) Severe bismuth poisoning may occur in spite of the absence of the blue line on the gums. (6) Bismuth is capable of eliciting the Jarisch-Hersheimer reaction. (7) Tertiary lesions of the mouth and tongue, and the symptoms of tabes, respond particularly well to bismuth therapy. (8) Bismuth may not be so powerful as mercury, but it is more convenient to use. (9) Bismuth and arsenobenzol have not such a strong effect on the Wassermann reaction as arsenobenzol and mercury. (10) Bismuth is invaluable in cases of nephritis, jaundice, and advanced organic disease, where mercury and arsenic may not be suitable, and in late syphilitic cases which have become resistant to arsenic and mercury. (11) The evidence is in favor of bismuth, arsenic, and mercury, being all capable of producing resistant spirochetes when administered in subtherapeutic doses. (12) Bismuth is not an efficient substitute for arsenobenzol. (13) Recent experiments by Kolle and Evers suggest that bismuth may have an *inhibitory* action rather than a curative effect, and at present our knowledge does not warrant the wholesale adoption of bismuth instead of mercury. (14) It is not established that bismuth is more effective than mercury in the permanent cure of syphilis, and it may be found that the curative value of mercury is higher than that of bismuth."

Bismarsen.

Bismarsen, otherwise called bismuth-arsphenamine-sulphonate, is a brownish-yellow, amorphous solid, easily soluble in water. The arsenic content is about 13 per cent and that of the bismuth 23 per cent.

For the treatment of syphilis, bismarsen should be administered by the epifascial route only, since injections into the belly of the muscle cause pain. The most satisfactory results have been obtained by employing 0.2 gram of the product in 1 cc. of sterile distilled water containing 2 drops of a 2 per cent solution of butyn as a local anesthetic. The best procedure for the treatment of either primary or secondary cases of syphilis is to start with an initial dose of 0.1 gram and then continue administering two 0.2 gram doses per week until a total of 20 injections have been made. After a rest period of two weeks a second course of 20 doses should be given and after another similar rest period a third course of bismarsen.

In tertiary cases it is best to employ a single course of ten to twenty 0.2 gram doses at the rate of 2 injections per week depending upon the general condition of the patient. Upon the latter also depends the advisability of administering a second or third course. This is a matter which must be determined in each patient.

It is said that bismarsen has a tendency to produce fewer immediate or delayed untoward reactions than arsphenamine, or any of its derivatives, with the exception of dermatitis. It rarely if ever causes severe dermatitis, jaundice, or encephalitis. Raiziss (confirmed by Stokes) states that in primary or secondary syphilis the production of negative Wassermann reactions has been at least as satisfactory as with the older arsenicals, and that in several so-called "Wassermann-fast" cases, reversals of the blood Wassermann reaction were obtained with bismarsen, after prolonged treatment with the usual antisyphilitic agents had failed.

Raiziss sums up its advantages as follows: (1) Comparative freedom of pain. (2) Low toxicity by the epifascial or intramuscular route. (3) High spirocheticidal properties. (4) Especially indicated in certain forms of latent, tertiary and neurosyphilis, as well as in persistently positive blood Wassermann conditions. (5) Valuable in the treatment of congenital syphilis. (See Bismuth Subsalicylate and Bismuth Potassium Tartrate.)

Bismuth Potassium Tartrate.

Under the name Potassium Bismuth Tartrate a preparation is marketed in ampoules holding 0.1 or 0.2 in oil suspension. The method of administration is to inject just above the buttock, as we inject mercury (see Mercury Salicylate), and the injection should be deep enough to be intramuscular or epifascial as described on page 400.

Bismuth Sodium Thio-glycollate.

This preparation sold under the trade name of Thio-Bismol contains 37.5 per cent of metallic bismuth. As it is freely soluble in water and in the tissues, it is used in cases of syphilis when rapid absorption is desired. It is particularly useful in arsenic-fast and mercury-fast patients and in those who have an idiosyncrasy to arsenicals. It is not as irritating as other preparations and so treatment is less painful. It may be given hypodermically, intramuscularly or intravenously. In most instances a dose is given every third or fourth day, the amount being 0.2 gram. Usually not more than six to eight injections are considered as a course, after which mercury is employed and after a month or more the bismuth is again resorted to. Thio-Bismol appears on the market in 2 cc. ampoules containing 0.2 gram of the drug in the form of a dry powder. The dose is prepared by opening the ampoule and injecting into it 1 cc. of sterile, distilled water. It is then shaken until solution occurs. This solution should not be kept but used at once.

Bismuth Subgallate.

The external uses of the subgallate of bismuth (*Bismuthi Subgallas*, U. S.) are identical with those of iodoform, and it probably acts in much the same manner as does the latter drug—namely, by so drying the wound that it becomes an unfavorable site for the growth of germs. As the subgallate is an astringent, it cannot be employed in the treatment of indolent ulcers, which need stimulation rather than an astringent influence, and it would seem probable on theoretical grounds that it is not to be compared to iodoform in the treatment of cases in which tubercular processes are active.

There is no doubt that subgallate of bismuth is less poisonous than iodoform, but it must be capable of producing some untoward effects if used freely for any length of time, since poisoning follows the prolonged employment of other bismuth preparations, as has been determined by Balzer, Dalché, and Villejean, for the symptoms of which see the article on Bismuth Subnitrate.

It may be tried in cases of skin disease in which there is much secretion, as in weeping *eczemas* and similar states, either in the form of a dusting-powder or in an ointment with vaseline or lanolin in the proportion of ½ to 1 dram to the ounce (2.0–4.0–30.0). Sometimes its efficiency can be much increased by the addition of a dram (4.0) of oxide of zinc to the prescription just given.

Bismuth subgallate has been used with marked success in case of *purulent otitis media* as a dusting-powder, and in other states requiring similar drying and astringent effects.

Internally, it has been highly recommended in cases of *fermentative* *dyspepsia* in the dose of 5 to 10 grains (0.3–0.6), but its real value in this condition is as yet undetermined.

When first introduced bismuth subgallate bore the trade name "Dermatol."

Bismuth Subnitrate and Bismuth Subcarbonate.

Bismuth Subnitras (U. S. and B. P.), and *Bismuth Subcarbonas* (U. S.), or *Bismuth Carbonas* (B. P.), occur as white amorphous powders. The subcarbonate may be a pale yellowish-white. They may be used interchangeably, as they possess the same properties. They are both insoluble in water except to a very slight degree.

Physiological Action.—Bismuth in the form of subnitrate and subcarbonate is ordinarily devoid of effect upon the general system, and locally applied externally, or when given internally, exercises a mild astringent and protective influence upon mucous membranes.

These bismuth preparations make the stools black, due to the subnitrate being changed into the suboxide.

It may produce chronic poisoning after prolonged use on wounds, or when internally administered in excessive doses, for some time. Ordinary doses are innocuous. As much as 4 to 5 drachms a day may be given for a short time without harm. The changes which ensue when the drug is abused are pallor of the face, the formation of a black line on the gums, black sloughs in the mouth and gastro-intestinal tract, swelling of the tongue, salivation, desquamative nephritis and albuminuria. The changes in the mucous membrane of the colon are thought to be due to the precipitation of a soluble form of bismuth, circulating in the blood, being precipitated by the hydrogen sulphide in the bowel, with the result that the capillaries are blocked and this results in local necrosis. A similar state may develop in the mucous membrane of the gums and tongue. Oliver states that a blue line on the gums resembling that seen in lead poisoning may develop.

A number of deaths have followed the development of these symptoms, and Böhme has shown that the subnitrate is capable, under the influence of certain bacteria in the intestine, of giving off nitric acid and nitrites, and the symptoms of poisoning have been shown by Böhme to be due to the latter. The hemoglobin is changed into methemoglobin, as it is when the nitrites are used medicinally in large amounts. For this reason the subcarbonate is to be used in preference to the subnitrate for roentgen-ray examinations.

The use of bismuth in single massive doses of as much as 2 to 4 ounces (60.0–120.0) for the purpose of rendering the walls of the stomach opaque to the *x*-rays in cases of suspected gastro-intestinal disease has produced in some cases nausea, vomiting, prostration, cyanosis, and rapid pulse and quickened respiration. Formerly this drug was supposed to be capable of producing acute gastro-enteritis, when given in large doses, but this was due to contamination by arsenic. Barium sulphate has largely replaced it.

Therapeutics.—Bismuth subnitrate and subcarbonate are used as mild astringents in large doses to cover the surface of *inflamed mucous membranes* and so to allay irritation. It is useful in *irritative vomiting* for this reason, and in *diarrhea* of a similar type in which the stools are serous. If the passages are mucous, castor oil should precede bismuth in order to rid the alimentary canal of the mucous secretion already poured out. It is very useful when combined with phenol in *serous diarrhea,* given in capsules containing 10 grains (0.6) of bismuth subnitrate and 1 minim (0 05) of phenol. It may also be used as a slowly acting and feeble antacid. Bismuth is of service in *dyspepsia* when lactic- and butyric-acid fermentation is present with excessive belching, and may be employed in *gastralgia* and *gastric ulcer* and *gastritis* as a sedative and astringent.

Milk of Bismuth (*Magma Bismuthi,* N. F.) is a suspension of hydroxide of bismuth now placed upon the market, the bismuth being minutely subdivided so that the tiny particles float in distilled water. It contains no glycerine, mucilage, sugar, or other substance, and each teaspoonful represents 5 grains of bismuth subnitrate. The dose varies from ½ drachm to ½ ounce, the latter dose being given to adults with gastric ulcer to overcome acidity and the smaller dose to children with *gastric irritation* or *acute gastric catarrh.* It may also be employed as a lotion to *superficial burns* and in *intertrigo* or sunburn.

Bismuth subnitrate mixed with yellow petrolatum in the proportion of 30 per cent has produced excellent results when injected into *tubercular* and other *sinuses* so as to thoroughly fill them. Enough force must be used to fill branch sinuses but not enough to tear the tissues. Before using, the paste is liquefied by heating it in a water-bath. Beck, the inventor of this treatment, states that if all parts are filled properly the creamy pus heretofore present will after twenty-four hours be found to be serous in character and sterile. Under these conditions reinjection is not necessary until the pus is no longer sterile, when they should be repeated weekly until sterile. Most of the injection usually exudes and the degree of its escape can be determined by the aid of the roentgen-rays. Not more than 1 ounce is usually necessary, and larger amounts may cause poisoning. If symptoms of poisoning arise, warm olive oil should be injected, allowed to remain twelve to twenty-four hours and withdrawn by a catheter and suction syringe. The opening should not be closed but dressed with gauze. After the discharge becomes sterile the paste may be replaced by sterile vaseline.

When the salts of bismuth are used for any length of time they cause the odor of garlic in the breath, which is due to the presence of an exceedingly slight trace of tellurium in the bismuth. The stools are apt to become black under the influence of bismuth, and the tongue, if furred, may also be black about the center when bismuth is used.

Where there is *chapping of the hands* or *cheeks* from exposure to cold or wet the following prescription is useful:

℞—Bismuthi subnitratis.	ʒiij (12.0)
Zinci oleatis	ʒiij (12.0)
Lycopodii	ʒij (8.0).—M.

S.—Apply to the parts t. i. d.

Bismuth Subsalicylate.

Subsalicylate of Bismuth (*Bismuthi Subsalicylas,* U. S., and *Bismuthi Salicylas,* B. P.) is largely used by some practitioners as an intestinal antiseptic in cases in which there is *diarrhea* due to fermentation or putrefaction. It may be given in powder, or, better still, in capsule, in the dose of 3 to 15 grains (0.2–1.0) several times a day. As already stated bismuth has definite antisyphilitic power. The more complicated preparations just named may be substituted by bismuth salicylate put up in ampoules containing 2 grains each in oil, giving it intramuscularly every seven days for 12 doses. Experiments have shown that it is more rapidly absorbed that the other insoluble preparations of this drug.

BORAX AND BORIC ACID.

Borax Purification, B. P., or *Sodii Boras,* U. S. Both borax and boric acid have been supposed to act as efficient germicides in strong solutions, but this has been proved incorrect. They are antiseptics, however, even in weak solutions.

Upon the body borax has little effect in any dose which is given for medicinal effect. It is rapidly eliminated and renders the urine alkaline. It is too rapidly absorbed from the alimentary canal to permit it to act as an intestinal antiseptic. Boric acid exercises even less effect upon the system than borax. Borax may also be used as a gargle in *diphtheria,* in *aphthous stomatitis, cancrum oris,* and *gangrenous stomatitis.* In the treatment of *pruritus ani* and *vulvæ* and in *bromidrosis* and *fetid sweating* it is of great value, when used in solution as a wash. Strong solutions, locally applied, are useful in *tinea tonsurans* and *tinea circinata.*

Borax has been used very largely in the treatment of *epilepsy,* with asserted success in some cases. Its employment is purely empirical. The dose used from 8 to 15 grains (0.5–1.0), gradually increased until it produces disturbance in the alimentary canal. As the taste is very disagreeable to most persons, the drug should be used with liquorice, strong coffee, or syrup of bitter orange:

℞—Sodii boratis	℥ss (16.0)
Glycerini	f℥j (30.0)
Fluidextracti glycyrrhizæ	f℥ij (60.0)
Aquæ destillatæ . . . . q. s. ad	f℥vj (180.0).—M.

S.—Dessertspoonful (8.0) in water after each meal.

If larger doses than 15 to 30 grains (1.0-2.0) a day are continued after the convulsions are decreased in number, there are two difficulties: first, the good effect is rapidly lost; and, second, untoward symptoms, such as nausea and diarrhea, with emaciation and the formation of a scarlatinal, eczematous, or papular eruption, appear. A peculiarity of the last two eruptions is that they are distributed around the joints.

A very useful wash for oral and nasal mucous membranes is "Dobell's solution," which is composed of—

℞—Sodii boratis,	
Sodii bicarbonatis	āā ʒj (4.0)
Phenolis	gr. xxx (2.0)
Glycerini	f℥j (30.0)
Aquæ puræ	Oij (960 cc.).—M.

Boric acid (*Acidum Boricum*, U. S. and B. P.) is one of the most commonly used substances in eye-washes, either alone or with cocaine. When used with cocaine or other drugs it is employed to prevent the destruction of the alkaloid or glucoside, as the case may be, by the growth of mould. The following formula may be employed:

℞—Cocainæ hydrochloridi	gr. iv vel viij (0.25–0.5)
Acidi borici	gr. x vel xx (0.65–1.3)
Aquæ destillatæ	f℥ij (60.0).—M.

S.—To be used by dropping into the eye.

The official ointment (*Unguentum Acidi Borici*, U. S.) or the following makes a very useful application for the skin of the face and hands to prevent *chapping:*

℞—Acidi borici	ʒj (4.0)
Ceræ albæ	ʒj (4.0)
Paraffini	ʒij (8.0)
Olei amygdalæ expressi	fʒij (8.0).—M.

S.—To be thoroughly mixed and applied night and morning.

If the form of a lotion boric acid has been used with some success as a remedy for *erysipelas*, and it may be similarly employed in *burns* and *scalds*.

Boric acid may be given internally in *cystitis* to render the urine acid, and is useful in the removal of *freckles* when applied as a wash to the skin. In persons having an idiosyncrasy to boric acid a bullous eruption of the skin may follow its use.

Borated lint is made by dipping lint into a boiling saturated solution of boric acid or borax. It is a simple, inexpensive antiseptic surgical dressing, and contains nearly one-half its weight of the drug. *Mel Boracis*, B. P., is not official in the U. S. P. It is used as a local application for *sore mouth.* (See Glycerite of Boroglycerin.)

BROMETONE.

Brometone is produced by the action of caustic alkalies upon bromoform and acetone; it occurs in fine white prismatic crystals which possess a camphoraceous odor and taste. Its melting-point is about 167° C. It is soluble in most of the organic solvents, as alcohol, ether, benzine, etc., slightly soluble in cold and more soluble in hot water. Its chemical name is tri-brom-tertiary-butyl-alcohol, and it contains 77 per cent of bromine.

The physiological action of brometone is nearly identical with that of the old bromides. Given in full doses it may, in susceptible persons, produce some dizziness, vertigo, loss of appetite, or mental heaviness, which are, however, only fleeting in their nature. Brometone may, therefore, be used as a substitute for the other bromides. It possesses the advantage of being powerful and therefore is efficacious in small doses varying from 5 to 10 grains (0.3–0.6); best given in capsules.

BROMIDES.

Bromides of Potassium, Sodium, Lithium, Calcium, Gold, Nickel, Ammoniun, Strontium, and Hydrobromic Acid.

Bromide of Potassium.

Bromide of Potassium (*Potassii Bromidum*, U. S. and B. P.) is the most commonly used and an important member of the group above named, and will therefore be spoken of before the others. It is very soluble in water, but less so in alcohol. This bromide has a salty taste, and is distinctly irritant to mucous membranes if locally applied in concentrated form. A certain portion of its depressant influence, particularly when it is given for long periods of time, depends upon the potassium as much as upon the bromine, and for this reason the sodium salt is preferable.

Physiological Action.—Bromide of potassium has an action upon the animal economy which is clearly defined and closely followed by all the other bromide salts, so that what is said in this place concerning its effects may be taken as representing the whole class of bromides, except in the instances where slight differences exist, which will be pointed out under the various names of the respective salts. When taken internally in full doses it produces drowsiness, sleep, and a decrease in all the reflexes. (See Effects of Prolonged Use.) Because of its potash base it is more depressant than the other salts, and should be used with care in nephritis.

Nervous System.—The bromide of potassium acts as a distinct depressant to the motor and to the intellectual portions of the cortex cerebri. It slows the development of thought and decreases the excitability and power of the motor cells of the brain (Albertoni).

Upon the spinal cord it acts as a marked sedative, affecting chiefly the sensory tracts, and causing thereby loss of reflex action and a decrease in the ability to recognize pain. It also depresses, but to a less extent, the motor pathways in the cord. Motion is maintained after sensations to pain and reflexes are lost. The drug depresses the peripheral parts of the sensory nerves, and after very large doses the motor nerves and muscles are similarly involved.

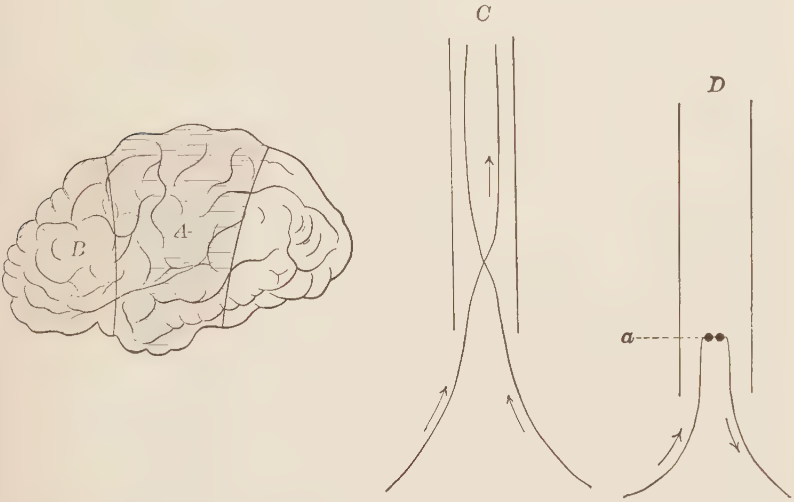

Fig. 16.—*A*, the bromides depress the motor areas and *B*, intellectual areas in the brain; *C*, they depress the sensory tracts in the spinal cord; *D*, they depress reflex action by depressing the sensory cells in the cord *a*.

Circulation.—If the drug be injected in ordinary dose into the jugular vein, it causes at once a fall of arterial pressure and pulse-rate. These changes are due to a direct action of the bromine and the potassium upon the heart. When given to a man in therapeutic doses by the mouth, its circulatory effect is so slight as not to be worthy of consideration unless the dose is very large and repeated.

Respiration.—In toxic dose bromide of potassium is a depressant to the respiratory center. In medicinal dose it does not affect the breathing, except when the amounts given are large and the drug persistently administered, when the breathing becomes slower.

Digestion.—The bromides may disorder the stomach by irritating its mucous membrane or by so decreasing reflex action that the proper secretion of gastric juice is retarded, with the result that digestion does not take place with sufficient rapidity. For similar reasons they may cause constipation.

Temperature.—No effect upon this function is noted unless the dose be enormous; when such a dose is given the bodily heat is progressively diminished, the fall of temperature being probably due to the circulatory and nervous depression produced, associated with the general failure in vital power.

Elimination.—The drug escapes unchanged very slowly with all the secretions, and is found in the sweat, urine, tears, semen, milk, and feces.

Tissue-waste is decreased when the animal economy is under the influence of one of the bromides.

Therapeutics.—From what has been said, it is evident that bromide of potassium is a remedy to be devoted almost entirely to the treatment of disorders of the nervous system, and its uses are, therefore, as various as the manifestations of perversion of nervous action can be various. In a word, it may be said that bromide of potassium is to be used wherever *over-excitement of nervous protoplasm* is present, but never where nervous symptoms are due to depression.

In *epilepsy*, which, to the best of our knowledge, is due to explosive impulses arising in the cerebral cortex, it is one of the best drugs we have if given in sufficient dose; and in all forms of minor spasm, due to heightened reflex activity, it is of service. Care should be used in giving this drug in epilepsy that it is not used so long as to impair the mental state and that maniacal excitement does not supplant the attacks of epilepsy. (See Epilepsy, Part IV.) In cases of *spasmodic contractions*, in the treatment of *hysterical females*, in *nervous startings* and alarm at sudden noises in adults and children, and in the nervous symptoms accompanying *pregnancy* and the *menopause* the bromides will be found of great value. The following prescription was recommended very highly by Goodell, and will be found of service in the latter states:

℞—Ammonii bromidi . . . . ʒij (8.0)
Potassii bromidi . . . . ʒiv (16.0)
Spiritus ammonii aromatici . . . . fʒvj (24.0)
Aquæ camphoræ . . . . q. s. ad f℥vj (180.0).—M.
S.—A dessertspoonful (8.0) to a tablespoonful (16.0) every four hours.

In *headaches* due to uterine trouble the pain is often felt at the top of the skull or at the back of the neck near the occiput. The cause of this trouble will sometimes be found to be in the *cervix uteri*, and relief under these circumstances can only be obtained when the uterus is treated and the bromides administered.

In *convulsions* in children and adults, combined with chloral, bromides are most efficient, and are sometimes of service in *incontinence of urine* due to vesical spasm. In *seminal emissions* due to a morbid excitability of the centers in the spinal cord, bromide of potassium is one of the best remedies we have, and in *satyriasis* and *nymphomania* it is of great service.

In cases where undue *irritability of the pharynx* and larynx prevents examination of these parts, one or two full doses will render an examination easy of performance by decreasing the local reflex activity.

This is a useful point to be remembered in relation to the treatment of pharyngeal and laryngeal disease.

In cases of *acute laryngitis* full doses of the bromides (60 to 120 grains [4.0–8.0] a day) are very useful to allay the pain and hoarseness.

The bromides are found to be of service in the *laryngeal crises* of locomotor ataxia, the explanation of this fact being as follows: The adductor center of the larynx is situated in the brain, and the abductor center in the spinal cord. The first closes the larynx, the second opens it, and in health they maintain a patulous tube by their opposition. In disease the spinal center (the abductor or opener) fails, and the adductor in the brain, being unopposed, produces closure of the tube with disastrous results. The bromide, by quieting reflex action, as well as depressing the adductor center in the cerebral cortex, prevents this accident.

In *whooping cough* with much mucous exudation the drug is rarely of benefit, and had better not be used. In *laryngismus stridulus* or any form of spasm depending upon local irritation the local trouble must, of course, be removed if possible and the bromides given. In *teething* the drug may be used to decrease reflex irritation and prevent convulsions, and it will decrease the *night-screaming* of children —which is often due to bad dreams—to a very extraordinary degree, even if the dose be quite small. As a soporific for the insane and in the *insomnia* of the overworked and that of nervous women the bromide of potassium is of great service, but ought to be used as a temporary measure only. (See Insomnia). It may also be employed with good results in *chronic alcoholism* and *morphinomania,* given in doses of 40 to 60 grains (2.6–4.0). In *migraine* and *neuralgia* due to eye-strain or nerve-strain, combined with caffeine, the bromides are almost specifics. The caffeine seems to stimulate the depressed nerve up to the normal level, and the bromide to deaden the perception of the pain. The following is a most valuable remedy in migraine, and also in sick headache. It ought not to be used in bilious headache, which will often be made worse by it:

℞—Antipyrinæ	gr. xxv (1.6)
Caffeinæ	gr. x (0.6)
Potassii bromidi	gr. xxv (1.6).—M.

Fiant chartulæ, No. v.
S.—One powder in water as needed.

In the treatment of *dysmenorrhea* and *menorrhagia,* particularly in young subjects, the bromides are also of service. (See Goodell's prescription, page 162). When the flow is too profuse, the drug should be begun a week before the expected epoch, and given in the dose of 5 to 10 grains (0.3–0.6) night and morning. In cases where the epochs follow one another too closely the drug should be used continuously. After an apparent cure ensues the bromide should be continued for a few periods to avoid a relapse. For *seasickness* the bromides are the best prophylactics we possess, and should be used in the dose of 5 to 10 grains (0.3–0.6) three times a day for several days before the patient sails, in order to quiet the vomiting center. After seasickness begins they should not be given in ordinary solution, but in an effervescing draught made as follows:

℞—Acidi citrici	ʒij (8.0)
Aquæ destillatæ	f℥iv (120.0).—M.

Fiat solutio.

℞—Potassii bromidi	ʒj (4.0)
Potassii bicarbonatis	ʒj (4.0)
Aquæ destillatæ	f℥iv (120.0).—M.

Fiant solutio.

S.—A tablespoonful (16.0) of each of these solutions should be added to one another and taken during effervescence.

This prescription will also be found of value in the persistent *vomiting of pregnancy* and in that following prolonged etherization or other states. If the vomiting is excessive, the dose ought to be reduced to 2 teaspoonfuls (8.0) of each solution, and be given every half-hour until half of each mixture is taken or the patient is relieved. In cases where this cannot be retained, a rectal injection of the following will be found of value:

℞—Sodii bromidi	gr. xxx vel ʒj (2.0–4.0)
Tincturæ opii	♏xxx (2.0)
Mucilaginis amyli	f℥vj (180.0).—M.

S.—To be injected gently into the empty rectum and retained as long as possible.

This method is one of the most reliable plans that can be followed.

Bromide of potassium may be used to prevent the development of symptoms of *cinchonism,* which often ensue after the use of quinine and salicylic acid, and it is said to prevent the nausea and depression so apt to follow the use of opium.

Administration.—The dose of bromide of potassium is from 5 to 120 grains (0.3–8.0) a day. It should be given at long intervals, as it is slowly absorbed and very slowly eliminated. After the patient is fully under its influence its effects can be maintained by smaller doses. The best way to order it is in a watery solution with a little syrup.

Use of Bromides in Poisoning.—Bromides are useful in nearly all convulsive attacks consequent upon the ingestion of poisons, and they may be used to allay any nervous symptoms arising from this cause which are of an exciting nature.

Poisoning.—Acute poisoning by the bromides is rare, but if ½ to 1 ounce is taken they produce a sense of warmth in the epigastrium, general feebleness, frontal headache, stupor, aphasia, and amnesia. The pulse-rate decreases 15 to 20 beats a minute; the pulse is irregular and compressible. Recovery takes place, as a rule, unless pulmonary edema set in. Occasionally the patient may become maniacal.

Effects of Prolonged Use, or Bromism.—After the drug has been used for some time in large doses acne appears about the face and extends over the entire body; the breath becomes fetid, the patient is dull, expressionless, and heavy, and remains buried in sleep during nearly every hour of the day. During this time he can be aroused, but at once sinks to sleep again. The gait becomes weak and feeble, the movements slow and prolonged. Taste is lost and hearing is benumbed, while the intellectual faculties of the brain are almost in abeyance. Loss of sexual power is an early symptom. In other cases evidences of mental aberration develop, the patient becoming irritable, morose, and even homicidal. Sometimes, however, we find melancholia and hallucinations, and rarely exalted ideas,[1] with symptoms resembling general paresis. In still others a dangerous suffocative bronchitis develops, the patient may become profoundly cachectic, or the condition may resemble typhoid fever. The acne may be prevented to some extent by the use of arsenic, and when the bromides are given to women this drug may be given simultaneously to prevent the eruption. As Fowler's solution is compatible with the bromide in solution, it is the best form of arsenic to employ. As the acne is due to a torpid state of the skin glands, it is also well in these cases to order the patient to wash with warm water and Castile soap every night, and afterward to dry the face by a vigorous rubbing with a rough towel. Feré has asserted that the maintenance of intestinal antisepsis by the use of naphthol or salol will prevent the development of acne and digestive disorder when the bromides are given.

Contraindications.—The bromides are contraindicated wherever there is general asthenia and feebleness of the nervous system, as, for example, in post-typhoidal and post-puerperal insanity. In senile softening of the brain they are also harmful. When the mucous membrane of the gastro-intestinal tract is irritated, they do harm. When the patient is subject to acne, they should be used with caution or avoided.

Bromide of Ammonium.

(See Ammonium Bromide.)

Bromide of Calcium.

Calcium Bromide (*Calcii Bromidum,* U. S.) was introduced into medicine as a nervous sedative and hypnotic, and was thought at one time to be an efficient substitute for the bromide of potassium. Its action on the nervous system is virtually identical with that of the potassium salt, and it has been found to be far less irritant and depressant than the latter. For some unknown reason it has never won the confidence of the profession, but it may be given with very good results in the dose of from 30 to 90 grains (2.0–6.0) a day, or even more in cases which are not readily effected by bromides. It may be employed in *hysteria* and *epilepsy* and in all the conditions in which the other bromide salts are indicated. It is sometimes of value combined with the potassium salt, since under such circumstances better results are gained than if a single salt is employed.

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[1] See Collective Investigation by author in the Therapeutic Gazette of June 15, 1897 and October, 1924; also article on Epilepsy, Part IV.

Bromide of Ethyl.

See Ethyl Bromide.

Bromide of Lithium.

Bromide of Lithium (*Lithii Bromidum,* U. S.) is much weaker than the other salts, and must be given in larger dose. S. Weir Mitchell stated that it is of value in *epilepsy* when the potassium salt fails. The dose is 30 to 90 grains (2.0–6.0) a day.

Bromide of Sodium.

Bromide of Sodium (*Sodii Bromidum,* U. S. and B. P.) is to be used in every instance where bromide of potassium can be employed. Its dose is the same, although it is asserted to be a little weaker physiologically, grain for grain, than the potassium salt. It is far less apt to disorder the stomach, and is not so generally depressing as is the bromide of potassium.

Bromide of Strontium.

See Strontium.

Hydrobromic Acid.

Hydrobromic Acid is an extremely irritant preparation, but is thought to be less apt to cause acne and other untoward effects than the other bromides. It is only to be used in the form of the dilute acid (*Acidum Hydrobromicum Dilutum,* B. P.) and to be given in the dose of from 1 dram to ½ ounce (4.0-15.0), 15 to 60 minims (1.0–4.0) B. P., well diluted with sweetened water. It has been highly recommended by de Schweinitz and others for *headaches* due to eye-strain in nervous women.

BROMINE.

Bromum is a dark red liquid of an excessively pungent odor, like that of chlorine, possessing extraordinary power as a caustic when applied to the tissues of the body. It is the most severe caustic we possess, and penetrates very deeply. It may be applied in *hospital gangrene* and other large *sloughs* by means of a glass rod. Bromine should be kept in glass-stoppered bottles in a cool place.

BROMOFORM.

Bromoformum, or Tribromomethane, is a clear, colorless liquid.

Therapeutics.—Although bromoform has been found capable of producing anesthesia when given by inhalation, its employment is confined to the treatment of *whooping cough,* in the dose of 1 to 5 minims (0.1–0.3) three times a day for the relief of the spasmodic cough. It may be put in a teaspoonful of syrup and mixed at the moment of taking. Bedford has suggested the following formula for its internal use:

℞—Bromoformi		♏xvj (1.0)
Alcoholis		f ʒij (8.0)
Glycerini		f ʒxij (45.0)
Tincturæ cardamomi compositæ	q. s. ad	f ℥ij (60.0).—M.

S.—Teaspoonful (4.0) t. i. d. in water.

This prescription should be compounded by adding the ingredients in the order named.

Bromoform tends to depress the vasomotor system, but does not seem to depress the heart itself. While it seems to possess therapeutic value, the large number of cases reported in which it has caused alarming symptoms has prevented the author from employing it.

BUCHU.

Buchu (U. S.) contains a volatile oil, which is probably the active principle, and a bitter extractive. It is official, under the name of *Buchu Folia,* in the B. P.

Therapeutics.—Buchu is used when it is desired to affect the mucous membranes of the genito-urinary tract which are chronically diseased, and particularly when these parts are below their normal tone. It does not increase the urinary flow to any great extent, but acts on the mucous membrane of the genito-urinary passages as a stimulant. It is employed in *pyelitis, cystitis* and *vesical irritation* of a chronic type. The following prescription is useful:

℞—Potassii citratis		ʒiv (16.0)
Spiritus chloroformi		f ʒiij (12.0)
Tincturæ digitalis		♏xxx (2.0)
Infusi buchu	q. s. ad	f ℥viij (240.0).—M.

S.—Two tablespoonfuls (30.0) three times a day. Shake the bottle before using.

If the urine is continually highly acid, muddy, laden with salts, and productive of *incontinence* by reason of the vesical irritation which it produces, buchu in the form of the fluidextract, in the dose of a teaspoonful (4.0) three times a day, combined with an equal amount of sweet spirit of nitre and 20 grains (1.3) of acetate of potassium will be of great service. For a child the dose of the fluidextract should be about 10 to 30 minims (0.9–2.0). If the vesical irritation is acute, buchu is contraindicated.

Administration.—The fluidextract (*Fluidextractum Buchu*, U. S.) is the only official preparation, and it should be always well diluted before it is given, in the dose, to an adult, of 1 dram (4.0) three times a day. The infusion is not official, but is made by adding 1 ounce (30.0) of the leaves to a pint (480 cc.) of water. The dose of this is ½ ounce (16.0) to 1 ounce (30.0). The official B. P. preparations are the infusion (*Infusum Buchu*), dose 1 to 2 fluidounces (30.0–60.0), and the tincture (*Tinctura Buchu*), dose ½ to 1 fluidram (2.0–4.0).

BUTYN AND BUTESIN.

Butyn is a synthetic local anesthetic which occurs as a white powder which is freely soluble in water. Applied locally to a mucous membrane it induces a rapid onset of anesthesia which is more persistent than is that induced by cocaine. Unlike the latter drug, it does not contract the bloodvessels of the part to which it is applied nor does it dilate the pupil or increase intra-ocular tension. In solution it may be boiled without deterioration. The strength of the solution for the eye is from 2 to 5 per cent. Its toxicity is greater than procaine but it is more powerful as a local anesthetic and, therefore, in the urethra and in the nose and throat it must be used with caution. In the urethra 1 per cent. For infiltration anesthesia not more than ¼ to 1 per cent solution should be employed. Butyn is precipitated if added to salt solution, but can be well combined with adrenalin. A very considerable number of cases in which toxic symptoms have followed the use of butyn have been reported in British literature. Butesin is not soluble in water, but is so in oils or ointments in the proportion of 0.5 to 1 per cent. Combined with picric acid as butesin picrate it is used in ointment form as a pain relieving dressing for *burns*.

CAFFEINE.[1]

Caffeine (*Caffeina*, U. S. and B. P.) is an alkaliod derived from *Thea Camellia* and the berries of *Caffea Arabia*, which also contain, upon roasting, an empyreumatic oil, caffeol or caffeone. Its solubility in water is increased by the presence of certain salts—*e. g.*, potassium bromide, sodium benzoate, sodium salicylate and others.

Caffeine is usually employed in medicine as caffeine and the citrated caffeine (*Caffeina Citrata*, U. S.; *Caffeinæ Citras*, B. P.). Citrated caffeine is not regarded by chemists as a chemical compound, but as a mixture of citric acid and caffeine; therefore "citrate of caffeine" is an incorrect term. It occurs as a white powder, odorless, having a slightly bitter, acid taste and an acid reaction. One part of citrated caffeine forms a clear, syrupy solution with about 4 parts of hot water. If more water is added, it is partly precipitated, but when 25 parts are added it is redissolved.

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[1] Theine derived from tea, caffeine, the active principle of coffee, and the alkaloid of guarana from South America, are chemically identical. All of the caffeine of commerce is really theine, although it is claimed that pure theine has a very different physiological action.

The empyreumatic oil, of which there is about ½ to 1 teaspoonful in each well-made breakfast cup of coffee, has no medicinal effects. It is perhaps the cause of the "biliousness" sometimes produced by the habitual use of coffee, due to the faulty digestion of this oil, which is also prone to disorder the digestion if taken alone.

Physiological Action.—NERVOUS SYSTEM.—On the nervous system caffeine acts as a rapidly-acting stimulant, exerting its chief influence on the brain and spinal cord. By its cerebral effect it causes increased rapidity of thought, and by its influence on the spinal cord it increases reflex activity, and for this reason is said to make people "nervous." It is important to remember that it has no effect on brain protoplasm except to increase its functional activity. Caffeine does not produce cerebral exhaustion unless it is taken in such a manner and such large doses as to interfere with sleep, rest, and the taking of food in ordinary quantities. Hollingworth has shown that an individual is enabled to do more mental work in a given space of time with caffeine than he is capable of doing without it, and that this increased work is not followed by depression or exhaustion. In other words, it acts as a lubricant does in machinery, increasing ability without causing exhaustion. H. C. Wood, Jr., has shown that it acts on the muscles in a similar manner, and Farr's studies on urinary output fail to show that it causes an increase of muscle break-down.

Hektoen and Le Count have shown that the continual use of caffeine in doses such as are commonly found in tea and coffee produce no lesions in any tissues of the body.

CIRCULATION.—Caffeine has been supposed to increase the pulse-rate and blood-pressure by stimulating the heart-muscle, but from recent studies in the United States and abroad it would seem probable that these changes are indirectly produced and due chiefly to its stimulating action on the nervous system. It quickens the pulse by stimulating the sino-auricular node or pace maker of the heart. Clinically, it certainly seems to raise the blood-pressure in many instances of low pressure.

KIDNEYS, TISSUE-WASTE, AND ELIMINATION—Caffeine increases diuresis by causing dilatation of the renal vessels, particularly in the glomerules, and by preventing the absorbent action of the tubules. It also exerts a direct stimulating influence on the secretory epithelium of the kidney, and therefore increases the amount of solids as well as of the liquids in the urine. Upon tissue-waste the drug acts as a depressant, and is therefore a conservator of the tissues. It is oxidized and destroyed in the body, being excreted as dimethylxanthin, or monomethylxanthin, or possibly as uric acid.

Respiration.—Caffeine acts as a valuable stimulant to the respiratory center.

Therapeutics.—Caffeine is a valuable *cardiac stimulant* and *tonic* as well as a *renal stimulant.* In the presence of urgent symptoms, due to cardiac failure, one-half ampoule, holding about 7 grains (0.6) of caffeine and sodium benzoate, may be given intravenously. It acts equally well in *cardiac* and *renal dropsies* for this reason, and is an invaluable remedy in such cases. So useful is caffeine in cases of *cardiac disease* that it has largely supplanted digitalis in the hands of some practitioners, but its action is so different from that of foxglove that it cannot be considered in the same class of stimulants. In *acute renal inflammation* it is contraindicated, because all stimulants are contraindicated when the part they influence is inflamed. In *opium poisoning,* owing to its stimulant effect on the respiratory center, caffeine is very valuable. It may be given by the mouth or rectum in the form of strong black coffee, which will aid in keeping the patient awake and add heat to the body, which is often very cold, or by the hypodermic needle. A cup of strong black coffee is often useful in relieving a paroxysm of *asthma.* In *headache* due to nerve strain caffeine combined with antipyrine or acetphenetidin, and one of the bromides, is often of the greatest service. (See Bromide of Potassium and Neuralgia.)

Roasted coffee is sometimes used to mask the taste of disagreeable medicine. After it is roasted and ground it may be employed as an antiseptic and deodorant dressing for wounds when the common antiseptics are not obtainable.

Administration.—The ordinary dose of caffeine is 2 to 4 grains (0.12-0.25).

Caffeina, U. S. and B. P., cannot be used hypodermically, owing to its decomposition in the presence of water. The following solution may, however, be used hypodermically: Salicylate of sodium, 30 parts; caffeine, 40 parts; and distilled water, 60 parts; or, in other instances, the following preparation, recommended by Huchard, may be employed: Benzoate of sodium, 45 grains; caffeine, 30 grains; distilled water, 75 grains. This mixture is to be heated, and 10 minims (0.6) given at a dose.

The U. S. P. has made *Caffeine Sodio-benzoas* official for this purpose. It is the preparation in ampoules which I always employ by the needle.

Untoward Effects.—Caffeine often produces so much insomnia when given in full doses in cases of cardiac disease that its use has to be discontinued. If its use is persisted in, it may produce a condition of delirium closely resembling that of alcoholism. This can be avoided by the simultaneous use of sodium bromide or morphine. The writer has also seen a marked rise of temperature in a patient follow its use in the doses of 2 grains (0.12) three times a day, but this is unusual. In certain persons the habitual use of coffee in excess in the presence of overwork and lack of sufficient rest and food may result in insomnia, tremors, palpitation, tinnitus aurium, gastralgia and emaciation.

CAJUPUT OIL.

Oil of Cajuput (*Oleum Cajuputi,* U. S. and B. P.) is a volatile oil. It is a stimulant, and in large amounts an irritant, to mucous membranes, but acts as an efficient *carminative* and *parasiticide* in moderate amounts. As a remedy for *tinea tonsurans* and *pediculi* it should be applied pure to the part affected and used with caution, for cajuput oil is capable of irritating the skin. In *diarrhea* of a serous type it is of value in the dose of 10 to 20 minims (0.6–1.3), ½ to 3 minims (0.03–0.18), B. P. (See Diarrhea.) *Spiritus Cajuputi* is official in the B. P.; dose 5 to 20 minims (0.3–1.2).

CALCIUM.

Calcium is official in a number of forms, and is to be distinctly separated in the mind of the student from calx or lime, which is an oxide of calcium. It is never employed as calcium, but as one of its salts. These are as follows: bromide of calcium (*Calcii Bromidum,* U. S.); calcium lactate (*Calcii Lactas,* U. S.); precipitated carbonate of calcium (*Calcii Carbonas Precipitatus,* U. S. and B. P.); chloride of calcium (*Calcii Chloridum,* U. S. and B. P.) glycerophosphate of calcium (*Calcii Glycerophosphas,* U. S. and B. P.); and as precipitated phosphate of calcium (*Calcii Phosphas Precipitatus; Calcii Phosphas,* B. P.). Calcium sulphate is also official in the B. P.

All salts of calcium are incompatible with acids.

Carbonate of Calcium.

The precipitated carbonate (*Calcii Carbonas Precipitatus,* U. S. and B. P.) of calcium is used in the treatment of *serous diarrhea* as an *antacid* and as a *local protective* in cases of *chapped skin* or *intertrigo,* particularly in young children. When given internally the dose is from 10 to 30 grains (0.6–2.0).

Precipitated carbonate of calcium is the slowest acting *antacid* which we possess, and for this reason the remedy is to be employed in acidity of the intestines, as it passes through the stomach to a very great extent unchanged. (For the varieties of diarrhea in which it is to be used see article on Diarrhea.) As an external application it is used in *sweating of the feet and hands,* and sometimes as a dry dressing to *ulcers.* It may also be used over *burns.*

Chalk.—Chalk is a native calcium carbonate, chiefly obtained from shells.

Prepared chalk (*Cretæ Præparata,* U. S. and B. P.) is given in the dose of 20 to 60 grains (1.3–4.0). By far the best method for its administration is in the employment of chalk mixture (*Mistura Cretæ,* U. S. and B. P.), which contains about 30 grains of the chalk to each ounce (2.0–30.0) of liquid. The dose of this mixture is from 1 dram (4.0) for a young child to an ounce (30.0) for an adult. In the treatment of cases of serous *diarrhea* chalk mixture is best given in combination with tincture of kino or the compound tincture of gambir and paregoric, in some such form as follows:

℞—Tincturæ kino		℥j (30.0)
Tincturæ gambir compositæ		f ʒij (8.0)
Misturæ cretæ.	q. s. ad	f ℥vj (180.0).—M.

S.—A dessertspoonful (8.0) every three hours until diarrhea ceases.

It is to be remembered that the chalk mixture acts very slightly as an astringent, and chiefly as an antacid and mechanical agent in the alimentary canal.

Chalk made into a paste may be used as a substitute for bismuth paste in the treatment of *sinuses.* (See Bismuth.)

Other preparations are compound chalk powder (*Pulvis Cretæ Compositus,* U. S.), composed of prepared chalk, acacia, and sugar, and given in the dose of 10 to 60 grains (0.6–4.0), and troches of chalk (*Trochisci Cretæ*). Preparations official in the B. P., but not in the U. S. P., are aromatic powder of chalk (*Pulvis Cretæ Aromaticus*), dose 10 to 60 grains (0.6–4.0), and *Pulvis Cretæ Aromaticus cum Opio,* dose 10 to 40 grains (0.6–2.4). Most of the carbonate of calcium passes through the bowel without being absorbed.

Calcium Chloride and Lactate.

Calcium chloride (*Calcii Chloridum,* U. S. and B. P.) when taken internally in large amount acts as an intense gastro-intestinal irritant, and may produce death by this means. It is to be distinctly separated from the chlorinate, or chloride, of lime, with which it is sometimes confused, for the latter is hydrate of lime or slaked lime, containing 30 per cent. of chlorine, while chloride of calcium is a hard, vitreous, friable substance, giving off no odor of chlorine and utterly different in its use, action, and appearance.

Much misunderstanding of the effects of calcium salts in general and of calcium chloride in particular has existed and pharmacologists and physiological chemists have much to learn as to its influence on the body. Normally present in the proportion of 10 milligrams per cent in the blood it is held at this level with remarkable constancy, and any decrease results in neuro-muscular irritability and even tetany. Its presence is also essential for the normal coagulation of blood, and its presence is needful for the maintenance of cardiac and vascular tone. It acts to maintain ionic balance with magnesium as does potassium and sodium. When given in amounts in excess of the body needs, it is eliminated chiefly by the bowel even after it is absorbed, the system taking care that the normal calcium level is not exceeded. Even if the usual intake of calcium in food is less than it should be, the body always has a reserve store of it in its bones.

The very common practice of giving calcium chloride to shorten coagulation time of the blood is useless unless it is shown that the serum calcium is below 10 milligrams per cent. This only gives the body the task of eliminating it. So, too, the common practice of administering calcium in some form in *rickets* is probably futile unless by the use of cod-liver oil, with its vitamine D, an agent is provided for its utilization, or ultra-violet light from the sun or the quartz lamp is employed, or again unless viosterol as an activating agent is provided. Ordinary milk provides quite enough calcium if its utilization is provided for. Just as digestive juices are essential if food is not to pass uselessly through the alimentary canal so are the above agents essential.

Investigations have shown that the calcium deposit in bone formation is tertiary calcium phosphate and it is characteristic of rickets that it is not deposited in the cartilage. This seems to be due not to any lack of calcium in the blood but to low phosphorus, yet phosphorus in the food does not correct the trouble which apparently is due to the fact that some undiscovered substance, perhaps a hormone is the absent agent. (See Cod-liver Oil and Vitamines.)

In regard to its use in *spasmophilia* and *tetany* it must be recognized that these conditions are often not due to calcium deficiency for in some instances a form of intoxication is held to be responsible, while in others these symptoms depend upon disturbance of the acid base equilibrium.

Calcium chloride has been used considerably to relieve *dropsy* and *ascites* (see Dropsy, Part IV) and it often succeeds if given in very large doses of several grams several times a day, provided the patient is on an otherwise salt-free diet. But even here the calcium is not the active agent any more than is ammonium when ammonium chloride is given for this purpose. In each instance the explanation of its diuretic effect, if it occurs, depends upon the balance of ions in the body. One theory is that the calcium ions displace the sodium ions whose presence in excess results in the retention of fluid in dropsy. Another theory is that when the calcium chloride is given the calcium ions are set free, acidity is increased and to counter-balance this the sodium unites with the chlorine which is then eliminated with much water. Even when serum calcium is below normal as in certain cases of severe nephritis, the use of calcium is not effective in raising the serum calcium perhaps because, as Winslow has asserted, this state is due to retention of phosphates with a resultant disturbance of ionic balance. It is evident, therefore, that the common uses of calcium chloride are haphazard in the extreme and that both theoretically and clinically it has not a wide usefulness.

For the protection of the bony system of the mother in pregnancy when calcium may be taken to supply the fetus, the use of calcium is not only theoretically but practically useful, but other salts than calcium chloride may well be used or food rich in calcium be given freely.

Calcium chloride or lactate may be used in *acute lead poisoning.* (See. Lead.)

Another use of calcium chloride, which is worthy of trial, is its employment in the treatment of *itching.* It should be given in the dose of 20 grains (1.3) three times a day to an adult and may be prescribed as follows:

℞—Calcii chloridi . . . . ʒij (8.0)
Tincturæ aurantii . . . . f ʒvj (24.0)
Aquæ chloroformi . . . . q. s. ad f ℥vj (180.0).—M.
S.—One or two tablespoonfuls (16.0–30.0) three times a day.

Smaller doses may be needed if the stomach is irritable. These doses usually produce some thirst. They should be taken about one hour after a meal. How it acts is unknown; perhaps in diminishing the hydrophilia of the tissues.

Small doses of calcium chloride have also been used to increase the coagulability of the blood in "*bleeders*" and to prevent attacks of *urticaria* by an influence on the blood plasma, particularly in those cases in which the state of the blood has been altered by the ingestion of acid fruits. When used the dose should be 20 grains (1.3) three times a day. Unfortunately, as already stated, it is apt to disorder the stomach. A better preparation for this purpose is calcium lactate (*Calcii Lactas,* U. S. and B. P.). Calcium chloride, or lactate, may also be used to relieve *albuminuria,* which is not dependent upon organic disease of the kidneys but to conditions in the blood which permit an escape of albumin through the renal bloodvessels. Indeed, its ability to control so-called *physiological albuminuria* may permit us to use it to differentiate albuminuria due to organic renal disease, which it cannot control, from that type called "functional" The effect of the drug upon bleeding and albuminuria is usually manifested within an hour or two and persists for several days. An important point to be remembered is that the too prolonged administration of calcium decreases rather than increases the coagulability of the blood. The use of the drug should therefore be stopped for several days after it has been taken for 6 or 8 doses.

It is also important to remember that some cases of *hemophilia* or *purpura* seem unable to absorb the calcium salts from the alimentary canal. Such cases may be treated by the use of calcium lactate hypodermically, the solution of which should not be stronger than 1 to 20 of water. Calcium chloride is too irritating for hypodermic use. In cases of jaundice demanding surgical interference the fact that the blood does not coagulate at a normal rate is always the dread of the surgeon. For such persons if the blood analysis reveals a low serum calcium, calcium chloride may be given intravenously using 5 cc. of a 10 per cent solution every day for three days. If this fails to make coagulation-time normal after the lapse of several days the injections are repeated. (See Hemostatic Serum.) Sterile ampoules containing 15 grains (1.0) of calcium chloride are now on the market for intravenous use. This plan does not always succeed because the delay in coagulation-time may be due to other causes than lack of blood calcium. Sharp reactions sometimes follow the intravenous use of calcium chloride. It should be given with great slowness and the injection stopped at the first sign of trouble. Great care must be exercised that none of the solution enters the perivenous tissues; if this occurs a slough may result. This danger may be diminished by placing the calcium chloride solution in 125 cc. of normal saline.

Ross has reported the successful use of calcium chloride and lactate when given by the mouth, in cases of *persistent dull headache* associated with heaviness, listlessness, a lymphatic temperament, and decreased coagulability of the blood.

Very large doses of the calcium salts have been recommended for the relief of persons suffering from *tetany* due to disease or injury of the parathyroid glands, for the *tetany of lactation* and *pregnancy* by W. G. MacCallum, Voegtlin and others, and also for *infantile tetany*. (See Parathyroid Gland.)

Under the name calcium gluconate a preparation equivalent to 13 per cent CaO or 9.3 per cent, calcium may be used as a substitute as it is non-irritating to the stomach and muscular tissues if given intramuscularly. The dose by mouth is about 1 dram (4.0) one-half hour before meals. Ten cc. of a 10 per cent solution is used two or three days by the needle and is not painful.

Calcium Hypophosphite and Precipitated Calcium Phosphate.

The hypophosphite of calcium and the precipitated phosphate of calcium have been used for the treatment of *rachitis*, generally in the form of the *Syrupus Hypophosphitum*, and the *Syrupus Calcii Lactophosphatis*, B. P. They are largely prescribed by druggists.

In *fractures* where the bone is slow in uniting, and in some cases of *phthisis* and *rickets*, the lactophosphates and hypophosphites have been thought to be of service. The use of these salts are usually futile unless cod-liver oil and sunlight are employed, as under these influences they may be utilized by the body.

It is worthy of note that these salts are of little value in tuberculosis after it is well developed. They do good, if at all, in the so-called beginning stages of the disease; and the good effects of the so-called syrups of the hypophosphites depend more upon the other ingredients present in them than upon the calcium salts they contain. In *dental caries* particularly that occurring in nursing women they are useful.

The lactophosphates are better than the hypophosphites, as the latter are probably changed into phosphates in the stomach as soon as they enter that viscus. The dose of either the lactophosphates or the hypophosphites is 10 to 30 grains (0.6–2.0) three times a day, or of the syrups just named a teaspoonful to a tablespoonful (4.0–16.0). The difference between these salts and phosphorus, both in therapeutical effect and in physiological action, is to be clearly borne in mind. The lactophosphates and hypophosphites are simply convenient modes of administering calcium, potassium, or other substances, while phosphorus acts as a stimulant to bone growth, and not by its deposition in the bone. Phosphoric acid does not act any more like phosphorus than does sulphuric acid act like sulphur.

Sulphate of calcium is not to be confounded with calx sulphurata, often wrongly called sulphide of calcium. (See Boils and Calx.)

CALUMBA.

Calumba (U. S.), *Calumbæ Radix* (B. P.). Columbo, or Columba, has bitter taste and its odor is slightly aromatic. Two alkaloids are found in it, berberine and columbine, and a third substance known as calumbic acid. Calumba is one of the purest bitters known, as it does not contain tannic acid.

Therapeutics—Calumba is one of the best simple tonics that can be used, owing to its lack of astringent effect and to its favorable action on mucous membranes.

In case of *gastro-intestinal atony*, particularly that following fevers and similar states, calumba will be found of service, and it is a valuable remedy in the convalescent stages of *summer complaint* and *serous diarrheas.* The following prescription of Dr. George B. Wood is very useful in *intestinal atony* when associated with flatulence, although its bulk is disadvantageous and its taste bitter:

℞—Pulveris calumbæ	℥ss (16.0)
Pulveris zingiberis	℥ss (16.0)
Sennæ foliorum	ʒj (4.0)
Aquæ bullientis	Oj (480 cc.).—M.

Fiat infusum.
S.—A wineglassful t. i. d.

Administration.—The fluidextract (*Fluidextractum Calumbæ*) is given in the dose of 15 to 60 minims (1.0–4.0); the tincture (*Tinctura Calumbæ,* U. S. and B. P.), dose ½ to 2 fluidrams (2.0–8.0 cc.). The dose of the infusion *Infusum Calumbæ,* B. P., is ½ to 1 fluidounce (16.0–30.0). *Liquor Calumbæ Concentratus,* B. P., is given in the dose of ½ to 1 dram (2.0–4.0).

CALX.

Calx (U. S. and B. P.), or Lime, or Oxide of Calcium, is an alkaline earth which is incompatible with acids, ammoniacal and metallic bases, borates, alkaline carbonates, and astringent vegetable infusions.

Therapeutics.—Lime is used for the purpose of acting as an escharotic, particularly on *old ulcers* and on *hairy growths.* It is never given internally except in the form of the hydrate, or slaked lime. As an escharotic application lime is used in the caustic *Potassa cum Calce.* When given internally it should always be used as *Liquor Calcii Hydroxidi,* U. S., B. P., or lime-water, and under these circumstances it acts as an *antacid,* as an aid to the digestion of milk by preventing too rapid and solid coagulation of the casein. Milk of magnesia or *Magma Magnesiæ* is far better for this purpose. One dram is as efficient as many drams of lime water and does not taste badly. It is also feebly astringent. Given to infants and nursing women, it is probably utilized in the body in the formation of bone. It is also of value in the excessive nausea and vomiting often seen in adults and children and due to acidity of the stomach. Here again magnesia is better but teaspoonful doses of milk and lime-water, equal parts, will often be retained by such patients when nothing else will remain in the stomach.

The dose of lime-water is 1 dram (4.0) to 1 ounce or even 2 ounces (30.0–60.0). Externally applied, lime-water is of value in *tinea capitis* and similar states, and was at one time a popular application in *burns,* when mixed with equal parts of linseed or olive oil, forming *Linimentum Calcis,* U. S. and B. P., or Carron oil. Picric acid is much better. (See Burns, Part IV.) As a local application in *membranous croup* and *diphtheria* lime-water has had a high reputation, and is believed to dissolve the membrane, but it does not compare in usefulness with peroxide of hydrogen. It may be used as a spray or by means of a swab.

Lime water for ordinary purposes may be made by adding a piece of unslaked lime as large as a walnut to 2 quarts of boiled and filtered water in an earthen jar; after stirring it thoroughly allow it to settle, and pour off the clear liquid into a bottle. More water may then be added to the lime until it is all used.

Calx Chlorinata.

Chlorinated lime (*Calx Chlorinata,* U. S. and B. P.) is the hydrate of lime, containing 30 per cent of chlorine, provided it is of official strength. It is an exceedingly irritant substance because of the chlorine which it contains, and is never used internally. It occurs as a white, or grayish-white, granular powder, exhaling the odor of hypochlorous acid, having a repulsive, saline taste, and becoming moist and gradually decomposing on exposure to air.

In water or in alcohol it is only partially soluble.

Much of the chlorinated lime sold is useless, containing too little or no free chlorine. Good chlorinated lime should be so laden with the gas that the face cannot be held near it without the eyes being severely irritated. Unless the chlorine is present, the lime is of no value, for the employment of chlorinated lime as a disinfectant depends upon the action of this gas, the lime being used merely as a vehicle and oxidizer, the gas by itself being difficult of application.

As a disinfectant for privies, drains, and sinks chlorinated lime is one of the best, if not the best, we possess. A few pounds of it may be added every week to the contents of a privy vault with great advantage, and a solution of it may be used in bed-pans and urinals. When the passages of a patient having typhoid fever are to be received in a bed-pan, a chlorinated-lime solution should be placed in the receptacle beforehand, so that the fecal matter or urine will fall at once into a disinfecting fluid, when the contents of the pan should be well mixed. The solution should be of the strength of 1 pound to 2 gallons. Chlorinated lime should be placed liberally over and about decaying animals, and in exhuming corpses sheets wrung out in a solution made as directed above will, if wrapped about the body, be found of service to destroy the stench.

Chlorinated lime, in the proportion of a level teaspoonful, rubbed up in a cup of water, and then diluted with 3 cupfuls of water, may be used to purify and disinfect germ-laden water in the proportion of 1 teaspoonful of this solution to 2 gallons. This produces no disagreeable taste in the water, as the proportion of free chlorine is only 4 to 5 parts in a million, but it is sufficient to destroy in ten minutes typhoid and cholera bacilli and the dysentery bacillus.

Thresh advises that in no case should less than 1 part of chlorine be added to 1,000,000 parts of water, and if the water is known to be foul, as when derived from a polluted river, 2, 3 or more parts should be added. His method is as follows:

1. Obtain a supply of high quality chlorinated lime in $\frac{1}{4}$-pound hermetically sealed tins.

2. A corresponding number of $\frac{1}{2}$-pound packets of sodium thiosulphate. This salt (usually called hyposulphate of soda and largely used in photography) is nearly tasteless and combines with all the available chlorine in about half its weight of chlorinated lime. From these the following stock can be quickly prepared:

3. Add the contents of a tin of No. 1 to 1 gallon of water and shake until uniformly mixed.

4. Add 1 packet of thiosulphate to 1 gallon of water and shake until dissolved.

A gallon of solution No. 3 will sterilize 8000 gallons of any ordinary clear well or river water in fifteen minutes, and if at the expiration of that time the 1 gallon of thiosulphate solution No. 4 be added to the water any excess of chlorine will be eliminated.

If calcium hypochlorite is obtainable it may be substituted; 15 grains (1.0) will sterilize 40 gallons of water in one-half hour.

Chlorine fumes will bleach many dyed goods, and therefore colored fabrics should not be exposed to them.

Chlorine gas, in a diluted form, has been used for the treatment of *aphonia* due to cold in cases where the aphonia persists for some weeks. It can be liberated by allowing a few drops of hydrochloric acid to fall upon chloride of lime or chloride of sodium.

The placing of chlorinated lime in saucers about sinks and closets for the purposes of disinfection is useless. When the chlorine is present in a sufficiently concentrated form to kill germs, it will also kill the occupant of the room. A deodorant effect may be obtained, but a bad smell, if it exists, even when overcome by a greater one, is not really gotten rid of.

The official preparations of the B. P. are *Liquor Calcis Chlorinatæ* and *Vapor Chlori.*

Calx Sulphurata.

Sulphurated lime (wrongly called calcium sulphide, *Calx Sulphurata* B. P.) is used to check inflammation and hasten suppuration; the dose is $\frac{1}{4}$ to $\frac{1}{2}$ grain (0.015–0.03). It is of some value in *acne pustulosa* and all forms of cutaneous suppuration. When sulphurate of lime is not obtainable and successive *crops of boils* appear it is often possible to relieve the patient by baking egg-shells in an oven, powdering them and then letting the patient eat 1 dram (4.0) or more of the powder each day.

The preparations of calx of the B. P. that are not official in the U. S. are the saccharated solution of lime (*Liquor Calcis Saccharatus*), dose 15 to 60 minims (1.0-4.0), and slaked lime (*Calcii Hydras*), used in making different preparations.

CAMPHOR.

Physiological Action.—Camphor (*Camphora,* U. S. and B. P.), if taken in very large doses produces epileptiform convulsions, preceded by vertigo, roaring in the ears and delirium. The pulse soon becomes rapid, feeble and running, and the skin livid, cold and covered with sweat. Intense heat and burning may be felt in the belly, and, if the poisoning be slow, evidences of gastro-intestinal and renal inflammation ensue. In small doses it acts as a stimulant and gives a sensation of warmth to the stomach, while the pulse may become more rapid and stronger under its influence. At the same time there is a sedation of the nervous system and a general feeling of contentment. In large medicinal dose camphor is thought by some to act as a sexual stimulant, and by others as a sexual sedative. The stimulant effect is probably only produced by doses large enough to produce irritation of the genito-urinary tract. The convulsions following poisonous doses are due to the action of the drug on the brain. The drug, although largely destroyed in the body, is chiefly eliminated by the kidneys as campho-glycuric acid, and also escapes by the breath and the perspiration.

Therapeutics.—INTERNAL USE.—Camphor is employed for the purpose of acting as a *nervous sedative* and *antispasmodic* in the treatment of nervous women and children, and as a *carminative* in individuals who suffer from *intestinal flatulence.* It is of value in nervous *dysmenorrhea* and *headache,* and is best combined with one of the new analgesics, such as antipyrine and acetanilid given in tablet form. As it is virtually a volatile oil so far as its physiological action is concerned, it will be found useful in *cholera* and in *cholera morbus,* and in all forms of *serous diarrhea,* but rarely in mucous diarrhea. (See Diarrhea.) In *chordee,* combined with bromides and similar depressants to the spinal cord, camphor is of great service in some cases, particularly late in the disease. In *adynamic fevers* it has been used as a diffusible stimulant by Graves and by many others since his time with success. Camphor is a very useful remedy in *depression* coming on in the course of acute and prolonged diseases, such as *croupous pneumonia* and *typhoid fever.* It may be given by the mouth or, if the emergency is a pressing one, by hypodermic injection. Under these circumstances it is best given in the dose of 5 grains (0.4) dissolved in almond oil, which should be perfectly sterile, but the fact that when used by the needle it is given in oil makes it too slow in effect to meet urgent symptoms within a few minutes. It is in the nature of a sustaining agent more than an active stimulant. Liquid petrolatum should never be used as a solvent as it has often causes the development of fibrous tumors and if it enters a vessel produces a dangerous type of oil embolism. When used in the nervous depression of *phthisis,* Alexander asserts that its continuous injection may result in cumulative action and develop the symptoms of mild camphor poisoning; but experience leads me to believe that very much larger doses than those hitherto considered wise are often efficient. In *hiccough* it is of great service, and in *cardiac palpitation* due to functional irritability it is of value. In old or atonic cases of *capillary bronchitis* and *catarrh* of the air-passages it is useful. In *chronic nasal catarrh* spirit of camphor when inhaled from the mouth of a vial gives off enough of the drug to stimulate secretion and tone up the parts. Camphor water is also of value as a *mouth-wash* in persons who have fetid breath.

Camphor may be inhaled or taken internally in cases of *cold in the head,* in the early stages, with great relief, and exercises a decided influence in aborting the attack. The following formula may be employed:

℞—Camphoræ	gr. v (0.33)
Extracti belladonnæ	gr. j (0.06)
Quininæ sulphatis	gr. x (0.65).—M.

Fiant tabellæ vel capsulæ, No. x.
S.—One every hour for four or five doses.

After the attack is well developed this is useless, but used early it will decrease the *frontal headache* and the *sneezing* and running at the nose. In *coryza* from unknown causes with much lacrimation and incessant sneezing, camphor will be found of benefit. It may be snuffed up the nostril in a fine powder, or powdered camphor may be put in boiling water and fumes inhaled. The spirit may also be inhaled from a handkerchief.

EXTERNAL USE.—Externally camphor may be used as a stimulant to *indolent sores* and as a useful addition in small amount to the precipitated carbonate of calcium as a dusting powder in *intertrigo*. In the form of a liniment camphor is used over *inflamed joints* from *sprains* or *rheumatism*, and in *myalgia* and *neuralgia* to relieve the pain and stiffness. A mixture of camphor and phenol is a useful application to *burns* and *small wounds*. (See Phenol.)

Camphorated alcohol, spirit of camphor, is a useful application for abortive purposes when used over *boils* in their early stages, if repeated two or three times a day for a few moments at a time. Following these applications, the skin should be dried and camphorated oil applied. Ringer and Tilt recommend that Eau de Cologne, saturated with camphor, be rubbed into the scalp in the *drowsiness and headache of the menopause*, and a lotion of equal parts of aqua ammoniæ and spirit of camphor dabbed on the painful or hyperesthetic spots at the top of the head, so commonly felt by nervous women at the change of life or during menstruation, will be found to give relief.

Administration.—Camphor is used internally in the form of the camphor water (*Aqua Camphoræ*, U. S. and B. P.), dose ½ to 2 fluidounces (16.0–60.0); the spirit of camphor (*Spiritus Camphoræ*, U. S. and B. P.), dose ½ fluidram (2.0), or in the form of the camphor itself, in pill, in the dose of 1 to 3 grains (0.06–0.2) in each pill.

The best preparation for internal use is the spirit, or the camphor itself may be given in pill or capsule.

For external use we have, official, camphor liniment (*Linimentum Camphoræ*, U. S. and B. P.) and soap liniment, or *Linimentum Saponis*, U. S. and B. P., which is the milder of the two. A compound tincture of camphor (*Tinctura Camphoræ Composita*), composed of opium, benzoic acid, camphor, and oil of anise, is official in the B. P., dose 15 minims to 1 fluidram (1.0–4.0). This preparation is practically equivalent to "paregoric." (See Opium.) *Linimentum Camphoræ Ammoniatum*, B. P., is composed of camphor, rectified spirit, and stronger ammonia.

CAMPHORIC ACID.

Acidum Camphoricum, made by the oxidation of camphor through the influence of acids, is the best remedy for the *night-sweats of phthisis*. In a large number of cases suffering from night-sweats the author has found this drug to act very favorably indeed where other remedies failed, and he has never seen it produce disagreeable symptoms.

It may be given in the dose of from 20 to 30 grains (1.3-2.0), taken an hour or two before the sweat is expected. In very obstinate cases as much as 60 grains (4.0) should be given, but under these circumstances it should be used in two separate doses of 30 grains (2.0) each, two hours apart, in order to avoid irritating the stomach. It is best given in capsule or cachet, as it is insoluble in water. In other instances camphoric acid may be given in the following formula:

℞—Acidi camphorici		ʒiv (16.0)
Alcoholis		f℥ij (60.0)
Mucilaginis acaciæ		f℥iij (90.0)
Syrupi aurantii	q. s. ad	f℥vj (180.0).—M.

S.—Dessertspoonful (8.0) to a tablespoonful (16.0) one hour before sweat is expected.

In the writer's experience, camphoric acid is possessed of little power in cases of bromidrosis.

CANNABIS.

Indian Hemp (*Cannabis*, U. S., and *Cannabis Indica*, B. P.) is the flowering top of the female plant of *Cannabis sativa*. It must be noted that this is an entirely different plant from Canadian hemp or *Apocynum Cannabinum* which in full doses is an intense irritant and drastic. The nature of the active principle has never been determined with certainty. It is claimed by some to be a resin, by others an oil to which the name *cannabinol* is applied. American-grown *Cannabis sativa* has, however, been proved by Houghton to be equally active with imported *Cannabis sativa*.

The selection of this drug is attended with certain difficulties because of the fact that the unfertilized flowering top of the female plant possesses the active constituent in greatest proportion and is the part usually chosen for extraction. The fruiting top is proportionately less active only because the seeds which make up a large part of weight of the ripe top, are without activity, as are also the stems. The leaves contain the same active agent as the blossoms but usually in smaller proportion.

Physiological Action.—Given in full dose to man, this drug causes exhilaration and incessant laughter arising from the slightest cause, the person seeming convulsed with merriment; in other cases the sensations are disagreeable, and even death may seem imminent to the deranged mind. Sometimes the sensation of very full breathing comes on, and the patient thinks he is about to burst from the inflation of his lungs. After this, deep sleep ensues, lasting for many hours, even as many as fourteen or fifteen, without intervals of wakefulness. One of the most constant and marked symptoms in poisoning in man is the sensation of prolongation of time, so that minutes seem like hours, and, in addition to this, a peculiar separation of the mental powers occurs, during which both hemispheres of the brain seem to think differently on the same subject. If the dose be very large, the respirations are slowed very considerably, but no death from the use of cannabis by man is on record, and enormous amounts have been given to the lower animals without causing a lethal effect.[1] Applied to a mucous membrane, it acts as a severe irritant, and then as a local anesthetic, but the primary effect is so powerful as to prevent its application to mucous membranes for the relief of pain.

Therapeutics.—Cannabis is one of the best additions to cough mixtures that we possess, as it quiets that *tickling in the throat,* and yet does not constipate nor depress the system as does morphine. In advanced *phthisis* it is justifiable to keep the patient constantly in a state of quiet comfort by its use. For the relief of *pain,* particularly that depending on nerve disturbance, hemp is useful. Before the introduction of antipyrine and its congeners, tincture of gelsemium and the tincture or extract of cannabis were our best remedies in the treatment of *migraine.* The gelsemium in such cases should be given in full dose, 20 drops (1.3) of the tincture, and be followed by 10 to 20 drops (0.6-1.3) of the fluidextract of cannabis, it being known that the sample about to be used is active. After this dose of gelsemium the patient should be carefully watched, lest he suffer from an excessive influence of the drug, as such an amount may produce great depression in susceptible persons. In true *migraine* with hemianopsia this treatment is often most effectual in aborting the attack. The prevention of further attacks is to be attained by the use of smaller amounts of the cannabis during the intervals, the gelsemium only being used at the onset of the symptoms. In *paralysis agitans* cannabis may be used to quiet the tremors, and in *spasm of the bladder,* due to cystitis or nervousness, it often gives great relief. In *sexual impotence,* not dependent upon organic disease, it is said to be of value combined with strychnine or nux vomica and ergot. It acts as a nervous sedative in *exophthalmic goiter.*

In *headaches* at the *menopause* cannabis is useful, and if the headaches are associated with constipation and anemia, iron and aloes should be given simultaneously. Where headaches are due to *retinal asthenopia* a very useful prescription, according to de Schweinitz, is as follows:

℞—Tincturæ nucis vomicæ	f ʒij (8.0)
Tincturæ cannabis	f ʒij (8.0).—M.

S.—15 drops (1.0), in water, twice or thrice a day.

The following prescription has been found to be very efficient in the hands of the author in treating various forms of abdominal pain unless due to ulcer:

℞—Tincturæ capsici	f ʒj (4.0)
Tincturæ cannabis	f ℥ss (16.0)
Tincturæ opii	f ℥j (30.0)
Spiritus chloroformi	f ℥j (30.0)
Tincturæ lavandulæ compositæ q. s. ad	f ℥iv (120.0).—M.

S.—Teaspoonful (4.0) every hour until pain is relieved.

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[1] The author has injected as much as 5 drams of a fluidextract, active in the dose of 10 minims to man, into the jugular vein of a small dog without producing death.

In cases of *uterine subinvolution, chronic inflammation, and irritation* cannabis is of great value, and it has been found of service in *metrorrhagia* and *nervous and spasmodic dysmenorrhea.* Not only does it relieve pain, but it also seems to act favorably upon the muscular bers of the uterus.

In *acute* and *chronic Bright's disease* cannabis often allays the painful sensations over the renal region, and has been recommended by some writers in the cases in which bloody urine is present. In *gonorrhea* it is said to decrease the discharge and prevent *chordee,* and it has supplanted the use of copaiba and cubebs in some practitioners' hands. It should not be used in the early stages of gonorrhea, but in the later or subacute stages. There is some foundation for the belief that in small doses it acts as a *sexual stimulant.*

The advantages possessed by cannabis are that it does not constipate nor cause after-depression and nausea. On the contrary, there is often an increase rather than a decrease of the appetite under its influence. In the Anglo-Saxon race the cannabis habit is practically unknown, but in the East Indies when used to excess it sometimes causes maniacal insanity, from which the patient nearly always recovers after some days, weeks, or months.

Administration.—The employment of this most valuable remedy is handicapped by its frequent lack of power—a fault which is largely dependent upon reasons already given. Only a preparation which has been physiologically tested should be used. The physician should always employ some preparation known by him to be active by personal trial before condemning the drug as a failure in a given case.

The dose of the solid extract (*Extractum Cannabis,* U. S. and B. P.) is from $\frac{1}{4}$ to $\frac{1}{2}$ grain (0.015–0.03), that of the fluidextract (*Fluidextractum Cannabis,* U. S.) from 4 to 20 minims (0.25–1.3), and that of the tincture (*Tinctura Cannabis,* B. P.) from 15 minims to 1 dram (1.0–4.0), 5 to 15 minims (0.3–1.0), B. P.

CANTHARIS.

Cantharis (U. S.), or "Spanish Fly," is really a beetle, known as *Cantharis vesicatoria.* According to Leidy, the vesicating substance is in the blood, the eggs and the secretions of the generative apparatus. The blistering substance contains cantharidin, an active principle, which has supplanted cantharis in the present B. P.

Physiological Action.—Locally applied to the skin, cantharides causes irritation and finally vesication. The blister produced may be quite large, and enough of the drug may be absorbed to cause fever and nervous excitement. The ingestion of a moderate dose of cantharides produces a sensation of warmth in the stomach and slight stimulation of the genito-urinary system, particularly the kidneys and urinary tracts. Large amounts produce great pain in the lumbar region, a sensation of heat in the bladder and the urethra, priapism, agonizing vesical tenesmus, widespread acute nephritis, bloody urine, which is scanty at first, and finally suppressed, with great irritation of the external openings of the genito-urinary apparatus. The inflammatory changes may cause sloughing of the penis or of the labia in the female.

Violent gastro-enteritis is nearly always a pressing condition. A diagnostic sign of cantharidal poisoning, when the beetles have been swallowed, is the appearance of pieces of the iridescent wing-sheaths or coats in the vomit. Thirst is always a prominent symptom of poisoning by cantharides.

Therapeutics.—Cantharides are employed internally and externally. When given by the mouth the tincture is used as a *uterine stimulant*, to affect the uterine mucous membrane and relieve *amenorrhea* in cases in which atony and depression are the cause of the depression. Some persons teach that the tincture of cantharides is a valuable remedy in small doses in the second stage of acute *desquamative nephritis*, but in the instances where the writer has seen it used it has aggravated the condition, although it is supposed to decrease the excretion of the albumin and blood. In the later stages, where the kidneys are relaxed and torpid or where *albuminuria* comes on on the slightest exertion, tincture of cantharides in the dose of ½ minim (0.025) three times a day is of service.

In cases of *chronic parenchymatous nephritis*, particularly where alcoholism is the cause of the disease and the kidneys are inactive, cantharidal tincture is sometimes used. In *chronic cystitis* it is of service, and it has been recommended highly in drop doses. The use of cantharides is of value in *incontinence of urine* of a minor degree, as that occurring in elderly or nervous females when coughing, sneezing or laughing, and will often give relief after years of suffering. In *chordee*, in the dose of ½ minim (0.025) twice or thrice daily, it is sometimes of service. For *impotence* depending upon *sexual excess* Ringer asserted that the use of 5 to 8 minims (0.3–0.5) of the tincture of cantharides, with full doses of the tincture of the chloride of iron and nux vomica, will often relieve the patient and enable him to beget children. This dose of cantharides must be given with caution. The drug has no true aphrodisiac influence even when given in almost toxic dose. In *gleet* of a very chronic type and in *prostatorrhea* it is of service. Dermatologists have used cantharides internally as a remedy in *psoriasis, eczema, lichen,* and *prurigo,* with asserted great success. The dose should not be large enough to irritate the stomach or kidneys.

Externally, cantharides are used in the production of blisters for the purpose of causing the absorption of effusions or as a *counterirritant* of some severity in cases of *deep-seated inflammations.* (See Counterirritation.) Care should be taken that a sufficient amount of the drug is not absorbed to cause strangury and renal irritation. In renal *congestions* and *inflammations* the use of cantharides as a counterirritant is often contraindicated because of this danger. Huchard and others have reported cases in which, without the disease of the kidneys, a cantharidal blister has produced violent acute nephritis, with resulting uremia. In proportion of ½ minim (0.025) of the tincture of cantharides to 40 minims (2.6) of water it is said to be an efficient application for *burns*, but how it acts is not known.

Administration.—The dose of the tincture (*Tinctura Cantharidis*, U. S. and B. P.) is from ½ to 5 minims (0.025–0.3), and it is the only preparation used internally. The cerate (*Ceratum Cantharidis*, U. S.) is used, spread upon muslin, to produce a blister, and the cerate of the extract, which is no longer official, is used for the same purposes and in the same manner. The cantharidal collodion (*Collodium Cantharidatum; Collodium Vesicans*, B. P.) is a method of applying the blister which is most cleanly, but there is more danger of absorption of the drug if it is used. *Emplastrum Cantharidis*, U. S., is also official. *Liquor Epispasticus*, B. P., is employed as a counter-irritant.

"Warming plaster" (*Emplastrum Picis Cantharidatum*) is a mild counterirritant plaster to be employed where a blister is thought to be too severe. The preparations of the B. P. other than those named are *Emplastrum Cantharidini* and *Unguentum Cantharidini*.

The unofficial plasters of cantharides are the best pareparations to use for the production of a blister. In order to obtain a perfect effect the skin should be washed thoroughly with soap and water and dried with a towel, which should be rough enough to produce reddening of the cuticle. After this the skin should be moistened with vinegar, and while wet the blister is to be applied.

CAPSICUM.

Physiological Action.—*Capsicum*, U. S., *Capsici Fructus*, B. P., or Cayenne Pepper, locally applied to the skin or mucous membranes causes redness, and, finally, in the case of mucous membranes, vesication. The alkaloid (capsicine) will also produce these changes in the skin. When used internally for any length of time in excess capsicum will cause a chronic or subacute gastritis with pain and discomfort over the liver and stomach. If single large doses are used renal irritation and inflammation ensue, with strangury and the passage of concentrated urine.

Therapeutics.—In cases of *atony of the stomach* due to general *debility*, errors in diet, and *alcoholism* of the chronic type capsicum is one of the best remedies we have. When the patient is suffering from *acute alcoholism* the gastric mucous membrane is often too much irritated to permit of its use, but after the lapse of some days it may be found of benefit for the purpose of increasing the digestive power. As a remedy for *subacute alcoholism* it is useful, since by its stimulating effect and hot sensation it often satisfies, at least to some degree, the craving for alcohol. Under these circumstances it should be used in the dose of 3 to 5 minims (0.2–0.3) of the tincture every four or five hours, or as the oleoresin in pill in the dose of ½ to 1 grain (0.03–0.06). The following prescription has been found of great service in these cases:

℞—Tincturæ capsici	fʒiss (6.0)
Tinctura opii deodorati	fʒij (8.0)
Spiritus chloroformi	f℥j (30.0)
Tincturæ lavandulæ compositæ . . q. s. ad	f℥iv (120.0).—M.

S.—Dessertspoonful (8.0) every four or five hours.

In the *flatulent colic* of old persons and young adults capsicum will be found not only to act as a carminative, but also to prevent the development of the gas. Sometimes in the *anorexia* of convalescence capsicum acts most favorably. In *chronic nephritis* it is of considerable service, and tends to check *albuminuria*, but it is only to be used in the chronic forms and stages of renal disease or in the treatment of functional torpidity of the kidney. The tincture is to be given under these circumstances in the dose of 10 minims (0.6) or less, but in some cases which are very chronic as much as 20 minims (1.3) may be used. The tincture of capsicum and glycerin, half and half, may be used as a gargle for *relaxed uvula* and *chronic pharyngitis*.

Capsicum may be used as a gastro-intestinal stimulant to aid in the absorption of other drugs. Applied externally, capsicum acts as a counterirritant, producing redness of the skin, but not a blister, in the ordinary individual. It is one of the best moderate counterirritants which can be used. Capsicum plaster (*Emplastrum Capsici*, U. S.) is useful in *lumbago* and *rheumatism* when placed over the affected muscles, and in *headache* when applied to the nape of the neck. The tincture is sometimes painted over *chilblains* which are unbroken. The following method, given by Ringer, is very efficacious in this annoying affection:

"Make a strong tincture of capsicum-pods by steeping them for several days in a warm place in twice their weight of rectified spirit of wine. Dissolve gum arabic in water to about the consistence of treacle. Add to this an equal quantity of the tincture, stirring together with a small brush or a large camel's-hair pencil until they are well incorporated. The mixture will be cloudy and opaque. Take sheets of silk or tissue-paper; give them, with the brush, a coat of the mixture; let them dry, and then give another coat. Let that dry, and if the surface is shining, there is enough of the peppered gum; if not, give a third coat. This paper should be applied in the same way as courtplaster to chilblains that are not broken and burns that are not blistered, and it will speedily relieve the itching and pain. It acts like a charm and effects a rapid cure. The same is true of discolored bruises. It likewise allays rheumatic pains in the joints."

The dose of capsicum is 1 to 5 grains (0.06–0.32) in powder, or food or in pill. The dose of the tincture of capsicum (*Tinctura Cap-*

sici, U. S. and B. P.) is 5 to 20 minims (0.3–1.3), and of the oleoresin (*Oleoresina Capsici,* U. S.), ¼ to ½ minim (0.015–0.025). The dose of the fluidextract (*Fluidextractum Capsici*) is 1 to 3 minims (0.05–0.2). The plaster (*Emplastrum Capsici,* U. S.) is useful for external applications. An ointment (*Unguentum Capsici*) is official in the B. P.

CARBON (CHARCOAL).

Carbo Ligni, U. S. and B. P., or Charcoal, is used externally as an application to *old sores* and *sloughs* to act as *a deodorant* and *antiseptic.* These things it accomplishes by the absorption of any liquids which may be present, thereby depriving germs of a nidus, and by its distinct oxidizing power. It may be applied in the form of a dry powder or in a poultice, which is, however, so uncleanly that other antiseptic dressings are preferable.

The poultice (*Cataplasma Carbonis*), if used, should be made in the following manner: Take of powdered wood charcoal ½ ounce (16.0), bread-crumbs 2 ounces (60.0), linseed meal 1½ ounces (45.0), and add boiling water 10 fluidounces (300.0). Macerate the bread-crumbs and meal for ten minutes over a fire, and then stir in the charcoal to the extent of half the amount just named. Spread out the poultice and sprinkle the remaining half of the charcoal over its surface, and apply while hot to the part affected.

Internally, charcoal is used in powder in many conditions, and acts very well indeed in cases of so-called "*sour stomach*" from which eructations of gas or sour liquids take place.

The following prescription will also be found useful in the *atonic* or *subacute gastric catarrh* of persons who are careless in eating and who have much belching:

℞—Oleoresinæ capsici	gtt. x vel xx (0.6–1.3)
Pancreatini	gr. xx (1.3)
Pulveris zingiberis	gr. xl (2.6)
Pulveris carbonis ligni	gr. xl (2.6).—M.

Pone in capsulas, No. xx.
S.—One or two t. i. d. with meals.

As ordinary charcoal is not always obtainable, it may be substituted by pieces of very thin toast burnt through and through until they resemble charcoal. If the attack is very severe and vomiting eventually ensues, the ejecta will commonly be found to be odorless and not sour, and the stools will also be almost odorless, though black. In *fermentative and acid diarrheas* in adults this method of treatment is often of value, the prescription given above being a valuable means of cure. When charcoal is used in any condition associated with irritation of the mucous membranes of the gastro-intestinal tract, it should always be very finely pulverized, and if the stomach or bowels are inflamed the capsicum must be excluded from the prescription.

As a filter for impure water, charcoal, in mass or in powder, is one of the most satisfactory substances we have.

CARBON DIOXIDE.

Carbon dioxide gas is constantly developed in the body in the processes of oxidation and is eliminated by the lungs. It has an important stimulating effect on the respiratory center, maintaining its activity. If artificial respiration is carried to excess the patient ceases to breathe because the normal amount of CO_2 is removed from the blood stream. Owing to this stimulant effect when CO_2 is present in proper amount it is now largely used by inhalation for the following purposes:

1. To control the rapidity and depth of respiration during the inhalation of the various anesthetics.
2. At the beginning of the use of the anesthetic to hurry the induction of anesthesia by inducing deep breathing.
3. To rapidly dissipate the anesthetic from the blood stream after the need for anesthesia has ceased to exist.
4. The full respirations tend to prevent *pulmonary collapse* and possibly pneumonia.
5. To aid in the elimination of alcohol from the body when it has been taken in excess.
6. To resuscitate persons who have inhaled carbon monoxide from automobile exhausts or illuminating gas.
7. Carbon dioxide has been used successfully in the control of *hiccough.* (Fig. 17.)

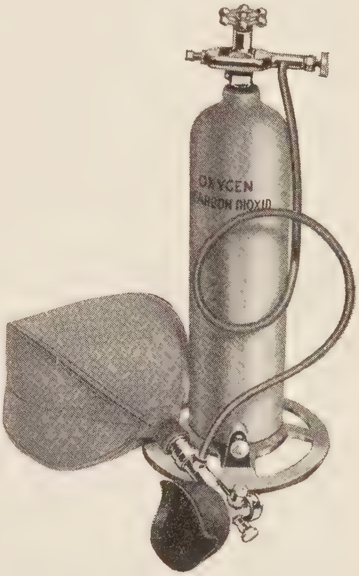

Fig. 17.—The administration of carbon dioxide-oxygen for hiccough. Oxygen containing from 5 to 15 per cent of carbon dioxide is used. Such gas mixtures may be procured from any manufacturer of medical gases through the local dealer. The *Inhaler* supplied has a *shut-off valve.* This is closed until the bag fills. The inhaler is then applied, the valve is opened and the patient breathes the mixture until relieved. A bag or two of gas is usually sufficient. (Heidbrink Co., Minneapolis.)

The percentage of CO_2 should not exceed 5 per cent as a rule. Tanks containing 5 per cent CO_2 and 95 per cent oxygen are obtainable.

If a mask is used care should be taken that the gas pressure is not too great, controlling the flow by a suitable cock and gauge.

CARBON TETRACHLORIDE.

Carbonei tetrachloridum, U. S. has been found to be very efficacious for the removal of *hook-worms.* It is important that the drug be very pure. The dose for an adult is from 15 to 45 minims (1 to 3 cc. followed in two to three hours by a purgative dose of magnesium sulphate. The drug is on the market in soft elastic capsules holding 20 minims. One dose will usually remove 80 to 90 per cent of the parasites. Its efficiency may be increased by using 2 parts of this drug with 1 part of oil of chenopodium. Deeks recommends giving 0.1 cc. of this mixture for each year of age up to twenty years. Before this remedy is resorted to it is wise to determine if there is associated infection with *ascaris lumbricoides* for carbon tetrachloride does not act as an efficient vermifuge for this parasite but causes an extraordinary activity in them so that many crawl into the stomach and even out of the nose, or form masses in the bowel which result in obstruction, or they may enter the larynx or bronchial tubes. Carbon tetrachloride has little effect on other intestinal parasites. It is best given in capsules.

Carbon tetrachloride possesses toxic properties in overdose, but in Fiji 42,000 patients were treated with no serious effects. Three deaths were due to the use of an impure sample. Its chief toxic effect is produced in the liver, the changes resembling those caused by chloroform. Patients should be kept under the observation for forty-eight hours after a dose and as a prophylactic measure it is well to protect the liver by means of a starch diet for a day or two before treatment. Carbon tetrachloride is of no value for round-worms and tape-worm, and is dangerous if the liver is out of order or diseased. It should not be given before the use of anesthetic, because of its deleterious effect on the liver. Alcohol must not be taken before or after the dose and chronic users of alcohol are prone to develop toxic symptoms. A second dose should not be given for three weeks. When a poisonous dose has been swallowed the stomach should be well washed out until the vomitus is free of the odor of the drug and then levulose or dextrose freely given by mouth, by rectum or even by vein to protect the liver. Alcohol is absolutely contraindicated.

Carbon tetrachloride (C. P.) containing 2 per cent of camphor is an excellent remedy for pruritus ani. Apply with small pieces of lint or gauze. It may cause smarting at first. See that the room is well ventilated to dissipate fumes. If the parts become too dry add a little lanoline to the mixture.

CARBROMALUM.

Carbromalum U. S. or adalin, brondiethylacetylcarbamide, is an odorless, almost colorless white powder, readily soluble in alcohol, but not in water. It is an efficient mental and nervous sedative closely resembling the ordinary bromides in power, and is a useful drug in cases of *mild insomnia* and *nervous irritability*. Taken for any length of time it sometimes causes skin lesions like the older bromides. The dose is 5 to 20 grains (0.3–1.3) generally given in tablet form. It is official.

CARDAMOM.

Cardamom (*Cardamomi Semen*, U. S.) is a bitter tonic possessing some aromatic properties. It is useful in cases of *atony of the stomach* and *small intestines*, particularly if combined with a mineral acid or some other bitter tonic, such as gentian. Cardamom is official in the B. P. as *Cardamomi Semina*.

If the intestine is atonic and secretion is deficient, the following prescription will be found of value:

℞—Acidi nitrici diluti . . . . fʒj (4.0)
Tincturæ cardamomi compositæ . . q. s. ad f℥vj (180.0).—M.
S.—Dessertspoonful (8.0) after each meal.[1]

Administration.—The official preparations of cardamoms are the tincture of cardamoms (*Tinctura Cardamomi*, U. S.), dose 1 to 2 drams (4.0–8.0); and the compound tincture (*Tinctura Cardamomi Composita*, U. S. and B. P.), which is to be given in the same dose as the tincture. This tincture also contains cochineal, cinnamon, caraway, and glycerin. Cardamom is also a constituent of the official aromatic powder (*Pulvis Aromaticus*, U. S.).

CASCARA SAGRADA.

Cascara Sagrada (U. S. and B. P.) is the bark of *Rhamnus Purshiana*, a plant growing in California. It is sometimes called California buckthorn, to distinguish it from ordinary buckthorn or *Rhamnus Frangula*, which it closely resembles in many ways, and which may be used as a substitute for cascara sagrada in some cases.

Therapeutics.—Cascara sagrada ought never to be used as a purge, but only as a laxative. It is by far the best remedy we have when employed simply to empty the bowel of fecal matter in cases of *constipation*, since it not only performs this function without intestinal disturbance, but also simultaneously acts as a tonic to the intestine, and so prevents the constipation which usually follows the use of all other drugs of its class.

In the United States cascara sagrada is most commonly employed in the form of the fluidextract (*Fluidextractum Cascaræ Sagradæ*, U. S., or *Extractum Cascaræ Sagradæ Liquidum*, B. P.), in the dose of from 10 to 20 minims (0.6–1.3), ½ to 1 fluidram (2.0–4.0), B. P., at night or morning and night. If 20 minims (1.3) fail to act 30 minims (2.0) may be used; but if larger doses are required, other drugs should be employed as adjuvants, as fluidram doses of the fluidextract of cascara may produce irritation of the bowel, and enteritis or intestinal catarrh. The objection to cascara sagrada is its bitter taste, which may be partially disguised by the additional use of Syrupus Aurantii, in the proportion of 1 part of the cascara extract to 2 parts of the syrup of orange peel, or the aromatic fluidextract of cascara sagrada (*Fluidextractum Cascaræ Sagradæ Aromaticum*, U. S.), may be given in the dose of from 10 to 30 minims (0.6–2.0). The B. P. has a preparation, *Syrupus Cascaræ Aromaticus*, which is given in the dose of ½ to 2 drams (2.0–8.0).

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[1] While the rule that an acid is incompatible with a tincture is not recognized in this mixture, the quantities of acid and alcohol are so disproportionate that ether in any amount is not developed.

Some of the preparations of this drug are now made in an almost tasteless form, such as "Cascara Cordial," an aromatic preparation useful for children who are constipated, or the non-bitter fluidextract made by a prominent firm in the United States and called "Cascara Evacuant," and used in the dose of 20 minims (1.3). The solid extract (*Extractum Cascaræ Sagradæ*, U. S.; *Extractum Cascaræ Sagradæ Siccum*, B. P.) is given in the dose of 2 to 8 grains (0.12–0.5).

CASTOR OIL.

Castor Oil (*Oleum Ricini*, U. S. and B. P.) is derived from the beans of *Ricinus Communis*, a plant of the United States and elsewhere, but originally derived from India. It contains an acrid substance, ricinoleic acid.

Physiological Action.—The manner in which castor oil purges is somewhat in doubt, but its activity probably depends upon the presence of ricinoleic acid set free by the alkaline juices of the intestine and the fact that it is an oil.

As is well known, oils—such as olive oil, for example—if given in considerable quantity, tend to move the bowels, and the ricinoleic acid, which is somewhat acrid, stimulates the small and large gut, and so develops peristaltic movement. That this acid possesses purgative properties of itself seems proved by the fact that the oil will purge when it is rubbed on the skin, and that nursing mothers on taking the oil may eliminate the acid in the milk to such an extent that the suckling is purged. According to the studies of Rutherford and Vignal, the oil has no effect over biliary secretions other than that violent purgation indirectly increases the flow, and the researches of Hess have shown that the oil acts more rapidly in the small than in the large gut, and produces peristalsis only by coming in contact with the mucous membrane.

Therapeutics.—Castor oil is the blandest and most unirritating purge we have, with the exception of the sulphate of magnesium, which is depletant and much more rapid in its effects. While Epsom salt will act in one-half to one hour if the stomach is empty, castor oil will generally act in four hours, or perhaps five.

Castor oil is used whenever irritant materials, such as bad food, putrid flesh or decaying or green vegetables, have been eaten, even if the inflammation set up after them is very active, but never if the pain is due, by any possibility, to appendicitis, perforation or obstruction except the latter be due to impacted feces. If hard bodies, such as broken cherry-stones, have been swallowed, castor oil is a far better purge than sulphate of magnesium, as it is more gentle and lubricates the gut, thereby preventing scraping and irritation. Where mucus has accumulated in the bowel in children, and must be gotten rid of before other treatment is resorted to, castor oil should be used.

Castor oil, for some unknown reason, except clinical experience, has a high reputation as an agent to induce labor at term and because of this should be given with caution, or not at all, in the later period of pregnancy. It is said by some practitioners to make the labor easier than if any other purge is used. It is also employed in the *constipation* following acute diseases and in that occurring in infants and children.

The disadvantages of castor oil lie in its taste, the fact that it is oily, that it tends to produce hemorrhoids if used constantly, and finally, that its frequent use, or even a single dose, is generally followed by more obstinate constipation than existed before, so that the dose must be rapidly increased in size to be effective. This is one of the reasons why it is useful in *irritative diarrheas*, for, having swept out the mucus and offending matter, it checks the movement of the bowels afterward. The purgative effect of castor oil is very much increased if a little bicarbonate of sodium is given with it.

A very effective purge in very obstinate constipation consists of 1 ounce (30.0) of castor oil with 1 ounce (30.0) of aromatic syrup of rhubarb.

Some cases of severe *neuralgic headache* may be cured by the use of small daily doses of castor oil. How it acts is not known, unless it unloads the bowels and so prevents toxemia, which in turn has caused nervous irritation.

Castor oil, to which has been added a few drops of balsam of Peru or oil of eucalyptus, when placed freely on gauze is an excellent dressing for *ulcers, wounds,* and *burns.*

Administration.—Castor oil is very much less disagreeable to the taste if pure than if poorly prepared. It is also true that too great purification renders it less active.

The methods directed for taking castor oil are as various as the tastes of individuals. Its odor may be masked by 1 or 2 drops of the oil of bitter almonds, but emulsions of the oil are not of any service, save to interfere with its efficiency. Some take oil in the foam of beer or porter, others in syrup of sarsaparilla and soda-water, and still others in milk or cream. A good way to take it is to eat one or two strong so-called cream peppermint drops, or even the crystalline peppermint drops, swallow the oil from a spoon which is to be placed well back in the mouth, and immediately eat several other peppermints. This plan is improved by using the oil in milk or water, so that the liquid carries the oil down into the esophagus without its touching the mucous membranes. It may also be taken in highly seasoned beef-tea. Ringer recommends the following: ½ ounce (16.0) of oil, fresh syrup of acacia 3 drams (12.0), and distilled water 5 drams (20.0), flavored with a little oil of lemon or peppermint. Wood advises that it be mixed with glycerin, equal parts, to which is added 1 or 2 drops of oil of cinnamon. Ritter advises the following formula:

℞—Saccharini	gr. ii (0.12)
Olei menthæ piperitæ	gtt. v (0.30
Alcoholis q. s. fiat solutio.	
et adde:	
Olei ricini	f℥viii (240.0)

Sig.—One or two tablespoonfuls as needed.

or,

℞—Saccharini	gr. ¼ (0.015)
Vanillini	gr. ⅛ (0.008)
Olei cassiæ	♏j (0.065)
Alcoholis	♏xv (1.0)
Olei ricini	f℥ij (60.0).—M.

Sig.—Two to four tablespoonfuls as needed.

By far the best way of administering it is in soft capsules containing from ¼ to 1 dram (1.0–4.0). Most persons can swallow as much as a teaspoonful in capsule, and several capsules containing this quantity, or a smaller amount, may be given at once to complete the necessary dose. The capsules should be dipped in water in order to render them slippery and so more easily swallowed.

The dose of castor oil for an infant is 1 to 2 fluidrams (4.0–8.0), and for an adult ½ to 1 fluidounce (16.0–30.0). Often, however, small doses will act when it is desired to sweep out of the bowel foreign matter that is causing diarrhea.

Owing to the fact that the oil will very frequently produce griping, a few drops of laudanum should be added to it, or tincture of belladonna may be used. If these cannot be employed, a drop of the oil of cinnamon is equally useful for this purpose.

Under the name of *Mistura Olei Ricini* the B. P. recognizes a mixture of castor oil made into an emulsion and given in the dose of 1 to 2 fluidounces (30.0–60.0).

CATECHU.

(See Gambir.)

CAUSTIC POTASH.

(See Potassium Hydroxide.)

CAUSTIC SODA.

(See Sodium Hydroxide.)

CEANOTHYN.

Ceanothyn is an extract, derived from *Ceanothus Americanus*, said to have the power of decreasing the coagulation-time of the blood in patients whose coagulation-time is abnormally slow. It can, therefore, be given before operation to prevent postoperative hemorrhage and to check such types of hemorrhage when once established. It is probably useless in instances of internal hemorrhage when coagulation-time is normal. Even when the doses are frequently repeated it is said to be devoid of toxic effects on other parts of the body.

It is given by the mouth, not hypodermically, in the dose of a tablespoonful every half hour until clotting occurs. If need be it can be given by the rectum, but if so the dose is to be doubled.

CERIUM OXALATE.

Therapeutics.—Cerium oxalate is often used instead of, or combined with, bismuth in the treatment of *vomiting*, and in some cases of *gastric acidity*. The dose is from 2 to 5 grains (0.12–0.3), given in pill-form every four or five hours.

CHENOPODIUM.

The oil (*Oleum Chenopodii*, U. S.) is a most efficient remedy for *Ascaris lumbricoides*, or *round-worm*. Recent tests show that this oil is often even better than thymol in *uncinariasis*, and its efficiency, unlike thymol and aspidium, seems to be increased by castor oil. The dose for an adult is 15 to 20 minims (1.0–1.3). The dose is 10 minims (0.6) to a child of five years either on sugar or in an emulsion made with acacia. If the patient is old enough, capsules may be used, and if it induces vomiting it may be given by the duodenal tube. The drug if too freely given is distinctly poisonous. The general dietitic measures adopted for the removal of worms should be insisted upon before the drug is given and a saline purge administered one hour after the drug is swallowed. (See article on WORMS.)

CHLORAL HYDRATE.

Although the name Chloral is applied to the substance used in medicine, chloral itself is never so employed, hydrated chloral (*Chloralis Hydras*, U. S.; *Chloral Hydras*, B. P.) being the real preparation.

Physiological Action.—When chloral is applied to a mucous membrane, it causes distinct reddening and burning pain, and finally acute inflammation. It is, therefore, a local irritant. Chloral acts in the body as chloral, and is not broken up into formic acid and chloroform, as was taught at one time.

NERVOUS SYSTEM.—In medicinal and toxic doses chloral produces sleep by quieting the intellectual centers in the brain, at the same time depressing the motor tract of the spinal cord and the motor nerves. It also depresses the motor area of the cortex. In medicinal amounts it does not decrease sensation, but in toxic doses it does. Very often hyperesthesia of the skin results from small doses. Reflex action is decreased by its sedative influence on the motor portions of the spinal cord.

Fig. 18

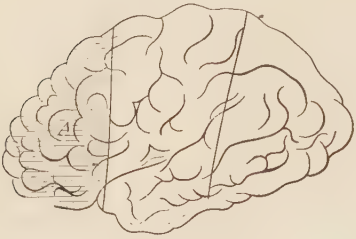

Fig. 19

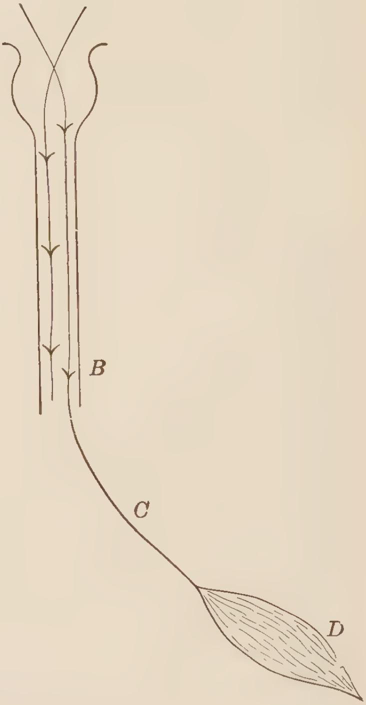

Fig. 23.

Fig. 22.

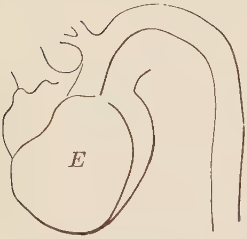

Fig. 18.—*A*, chloral causes sleep by quieting intellectual centers in brain.

Fig. 19.—*B*, depresses motor centrifugal tracts of cord; *C*, depresses motor nerves; *D*, does *not* depress the muscles.

Fig. 20.—*E*, depresses heart muscle.

Fig. 21.—*F*, depresses the respiratory center in the medulla.

Circulation.—A dose of 10 to 20 grains (0.6–1.3) in the healthy adult rarely causes any circulatory change, but larger amounts produce a fall of arterial pressure due to depression of the vasomotor center, and a slow, feeble, or sometimes a rapid-running pulse, due to a direct depression of the heart-muscle, for chloral in overdose is a cardiac paralyzant.

After death from chloral the blood may be found dark and grumous looking, with the corpuscles broken down, but these changes occur only after very large doses.

Respiration.—In moderate amounts no respiratory effect is felt, but in toxic doses the breathing becomes slower and slower and more and more shallow, until it stops in death. When death is caused by chloral it is primarily due to centric respiratory failure, but there is an almost simultaneous arrest of the heart.

Temperature.—Chloral tends to lower bodily heat, and in toxic doses produces a marked fall of temperature, which does much toward causing death. Brunton found that animals will survive very large doses of the drug if external heat is supplied to them. The fall of temperature is, at least in part, due to failure of the circulation and to vascular dilatation.

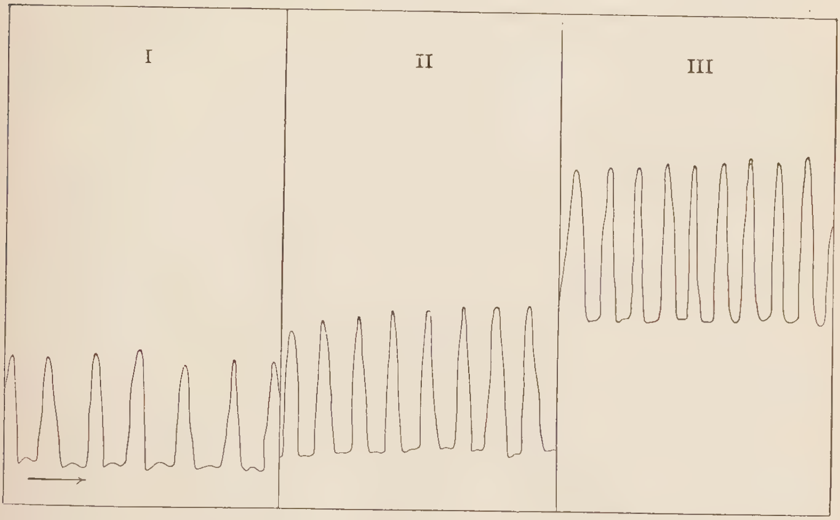

Fig. 22.—Shows the effect of digitalis in raising blood-pressure and pulse-force in chloral poisoning (after Schmiedeberg): In *I* the pressure is very low because of the effect of a large dose of chloral; the blood-pressure is 40; in *II*, after the injection of digitalis, it is 60; and in *III* it is 125 and the individual pulse-beat is far stronger than before.

Kidneys, Tissue-waste and Elimination.—Chloral is eliminated by the kidneys in combination with glycuronic acid in the form of urochloric acid, and, if given in excess, as chloral. Poisonous doses irritate these organs, and may produce bloody urine, owing to the nephritis which is set up as the drug passes through the renal structures. After chloral is ingested, the urine of a patient will often react to Fehling's and Trommer's test for sugar.

Poisoning.—When a poisonous dose of chloral is taken, the individual soon falls asleep and then sinks into a deep coma. The respirations become at first slow and labored, then shallow and feeble. The pulse, at first perhaps a little slowed, soon becomes thready and shuttle-like, and is finally lost at the wrist. The face is white and livid, the forehead and the hands covered with a cold sweat, and the pupils, which are at first contracted, soon become widely dilated. Absolute muscular relaxation is present, and it is impossible to arouse the patient.

Very large doses of chloral have been swallowed and retained without causing death. The average lethal dose for a healthy man is generally said to be $2\frac{1}{2}$ drams. Much depends upon the state of the heart-muscle. Acher has recorded a case in which 330 grains (22.0) of chloral and the same amount of bromide of potassium were taken at one dose with the recovery of the patient, and Daley has recorded an instance in which recovery followed a dose of 595 grains (40.0).

TREATMENT OF POISONING.—The physician should apply external heat and use emetics in the early stages, or, if the case is seen too late for emetics to act because of systemic depression, he should use the stomach pump. This latter means of removing the drug from the stomach is safer and more reliable, because the production of vomiting may result in efforts which will strain the heart. Strychnine should be given in full dose, $\frac{1}{20}$ to $\frac{1}{10}$ grain (0.003–0.006), to stimulate respiration and the vasomotor system, and atropine may be used for the same purpose. It has been shown that caffeine is valuable not only because it stimulates the respiration but also because it overcomes the hypothermia. The heart is to be supported by a full dose of tincture of digitalis, but, as digitalis is rather slow in its action, it should be preceded by ether and ammonia or brandy or whisky. The patient must not raise the head to vomit, and the head should be placed on a lower level than the heels to aid in maintaining the circulation of blood in the vital centers at the base of the brain.

IN CHRONIC POISONING by chloral or in cases in which the patient has come to use the drug as a habit the patient suffers from weakness, mental and physical, with sudden flushings due to vasomotor disorder, from palpitation of the heart, and finally from petechial eruptions, bed-sores, ulcerations and sloughs.

Therapeutics.—Chloral is one of the purest hypnotics that we have, and may therefore be used where simple *nervous insomnia* is present, but not when *sleeplessness* is due to pain. When pain is present it is to be employed in the combination of 10 grains (0.6) of chloral with $\frac{1}{6}$ grain (0.01) of morphine, as a much more powerful hypnotic effect is produced by the combined action of the two drugs than by the use of either one of them alone.

The following prescription may be used:

℞—Chlorali hydrati	ʒij vel iv (8.0–16.0)
Morphinæ sulphatis	gr. ij (0.12)
Syrupi lactucarii	f℥ij (60.0)
Aquæ destillatæ . . . . . . q. s. ad	f℥iij (90.0).—M.

S.—Dessertspoonful (8.0), in water, at 10, and at 11 P.M. if necessary.

Another formula is found on the next page.

In *tetanus* and *strychnine poisoning* chloral is one of the best remedies we have, as it depresses the motor tract of the spinal cord. In such a case it should be given in 20-grain (1.3) doses combined with 60 grains (4.0) of bromide of potassium. If the convulsion prevents deglutition or is brought on by swallowing, these remedies should be used by the rectum dissolved in starch-water; and if the spasm expels them from the rectum, the patient should be chloroformed long enough to allow the injection to be given and absorbed. The same remedies in small doses are to be used in *infantile convulsions*, and in *infantile colic* in the dose by the mouth of ½ to 1 grain (0.03–0.06) of chloral to 2 grains (0.12) of bromide of potassium or sodium in a teaspoonful of peppermint-water and syrup. In *chorea*, *paralysis agitans*, and *delirium tremens* chloral is of great service, but must be given cautiously in the last-named condition, for fear it may depress the heart, which is already diseased by alcoholic excess. Cases are on record in which chloral has caused sudden death from cardiac failure in alcoholics with fatty heart—an accident the liability to which is increased by the fact that owing to the addiction of the patient to a narcotic drug it requires large doses of the chloral to produce sleep. In *uremic convulsions* chloral has been highly extolled, but if any acute renal trouble is present, it must not be used lest it irritate the kidneys. In *puerperal convulsions* not dependent upon nephritis 20 to 30 grains (1.3–2.0) of the drug may be given, and repeated in one or two hours.

Hiccough, *nocturnal epilepsy*, and *whooping cough* are all indications for its use, but in asthma it rarely does good, and if pushed is dangerous to the heart.

Probably because of its counterirritant properties chloral is sometimes used locally over neuralgic nerves as follows:

℞—Chlorali hydrati		gr. c (6.5)
Camphoræ		ʒvj (24.0)
Olei gaultheriæ		fʒj (4.0)
Alcoholis	q. s. ad	f℥j (30.0)

or, instead, rub together in a mortar equal parts of chloral and camphor and use the resulting liquid. This avoids the odor of wintergreen which is disagreeable to some persons.

Untoward Effects.—Chloral sometimes causes nausea, purging, and vomiting by reason of its irritant action. In susceptible persons doses of 10 to 15 grains (0.6–1.0) have produced marked redness and swelling of the conjunctiva. Sometimes the last-named symptoms are only produced when an alcoholic beverage is taken simultaneously. In still other cases an erythematous, papular, urticarial, vesicular, or petechial eruption may ensue, the latter forms being seen as a rule in cases of chronic chloralism to which the drug is given.

Administration.—Chloral is best given in syrup of acacia, simple syrup, or water. It should always be well diluted. The syrup of chloral (*Syrupus Chloral,* B. P.) is given in the dose of ½ to 1 fluid-dram (2.0–4.0). The following prescription is useful in insomnia.

℞—Chlorali hydrati	ʒj vel ij (4.0-8.0)
Potassii bromidi	ʒij (8.0)
Syrupi pruni virginianæ	f℥j (30.0)
Aquæ destillatæ	q. s. ad f℥iij (90.0).—M.

S.—Dessertspoonful (8.0) to a tablespoonful (15.0) in water at night.

Sometimes chloral can be well given in junket by adding it to a liquid rennet, and then adding the rennet to the milk. (See Junket, Part III.)

It is well to remember that if soluble salts like the bromides of sodium or potassium are placed with chloral in a prescription which also contains alcohol, chloral alcoholate may be formed which is very irritating to the stomach. Alcohol should therefore be avoided, if possible, in such prescriptions.

The question as to the safe dose of chloral is one largely governed by the susceptibility of the patient, but alarming symptoms have followed a dose of 30 grains, and death after from 30 to 45 grains. Thirty grains in twenty-four hours are certainly ample in most cases.

CHLORAL FORMAMIDE (CHLORALAMINE).

Chloral formamide (*Chloral formamidum,* B. P.) is a compound formed by the addition of formamide to anhydrous chloral, and is a colorless crystalline substance without odor and of a somewhat bitter taste. It is soluble in 19 parts of water and 1.6 parts of alcohol. Chloral formamide keeps well in watery solution without decomposition. Its physiological action is closely allied to that of chloral, except that it is not quite so depressing to the circulation. Upon the nervous system it acts chiefly upon the brain and spinal cord, and produces sleep—a result to be expected, since both chloral and formamide are hypnotics. It is said not to irritate the stomach and kidneys, but it probably is only less irritant than chloral.

Therapeutics.—Chloral formamide may be employed in medicine whenever chloral may be used. It is decidedly a nervous sedative, and in the wakefulness of *nervous insomnia* is very useful. Sleep generally ensues about thirty or forty-five minutes after it is taken. According to most of the reports published so far, the drug relieves pain as well as produces sleep, and is therefore distinct in its action from chloral. In *neuralgia* it is very useful, and it has been found of value in the pains of *tabes dorsalis.* The dose is 10 to 30 grains (0.6–2.0), which may be repeated in three or four hours, although the sleep generally lasts five to eight hours. The following formula may be used for its administration:

℞—Chloralformamidi	gr. xl (2.6)
Acidi hydrochlorici diluti	♏v (0.3)
Syrupi	f℥ij (8.0)
Aquæ destillatæ	f℥ij (60.0).—M.

S.—Take in two doses in a little water.

The late Professor Charteris claimed very extraordinary results in the treatment of *seasickness* by the use of equal parts of chloral formamide and bromide of potassium. He gave it in the dose of 30 grains (2.0) with an equal amount of the bromide. It is necessary for the patient to take a cholagogue for two days before starting on the voyage, and as soon as he boards the ship to take the dose named on an empty stomach, and at once go to bed and sleep. If this is done, Charteris claimed that the patient will awake feeling bright and well, and remain so for the rest of the voyage. This combination under the name of "chlorobrom" has been also largely used as a hypnotic in the treatment of the *insomnia* due to melancholia and acute mania.

This drug is not to be confused with Chloramine.

CHLORETONE.

Under the name chloretone a substance, which is trichlor-tertiary-butyl-alcohol, or acetone chloroform, is often used as a *hypnotic* and *nervous sedative* closely allied in its uses to chloral, yet different in the important particulars that it does not depress the heart or respiration unless given in excessive quantities, and does not irritate the stomach, but acts as a sedative to this organ. For this reason it can be used with advantage in *vomiting* due to irritation. Given in the dose of 5 to 10 grains (0.3–0.65) before etherization, it will often prevent *after-vomiting*, and if vomiting has already begun, is a valuable agent for its relief. When used to prevent *ether vomiting*, it should be given in powder one hour before the ether is used. It is a valuable remedy to prevent and relieve *seasickness*, in doses of 3 to 5 grains (0.2–0.3) three times a day. Chloretone is an efficient palliative in *tetanus*, given by the rectum in the dose of 60 grains (4.0) dissolved in warm olive oil, and repeated as often as is needed to control spasm.

The author has also found it of value in relieving the pain of *gastric ulcer* and of *carcinoma*. As it is both anesthetic and antiseptic, it can be employed as an application to *burns*, *scalds* and *lacerations* in 10 per cent ointment, and local anesthesia may be produced by the subcutaneous injection of it in a 1 per cent solution of alcohol 15 per cent and water 84 per cent. It may be dissolved in oil of cloves and applied on a cotton pledget with advantage in cases of *toothache*. It may also be used to benumb a *painful dental nerve* by mixing equal parts of ether and chloretone and applying this in the cavity. Powdered chloretone mixed with equal parts of powdered boric acid and dusted over *painful ulcers*, *burns*, and *lacerations* or *wounds* acts as an efficient antiseptic dressing, but it may increase the burning at first. Chloretone and antipyrine may be given in capsule in the dose of 3 to 6 grains (0.2–0.4) each and used in *restlessness* and *neuralgia pain*.

The mixture of these substances results in liquefaction, but this does not interfere with their therapeutic efficacy.

Chloretone is efficient in doses of from 5 to 20 grains (0.3–1.3), and is best given in 5-grain capsules or in pills of about 3 grains (0.2) each. Large doses often cause headache as the effects wear off.

It is frequently used by some anesthetists in the dose of 20 grains (1.3) in oil by the rectum two or three hours before an operation in order to permit surgical anesthesia with a minimum of ether.

CHLORINATED LIME.

(See Calx Chlorinata.)

CHLORODYNE.

Chlorodyne is a preparation used largely for the treatment of *serous diarrhea* or *cramps in the abdomen.* Its constitution varies considerably, but the formula most commonly employed is as follows:

℞—Morphinæ hydrochloridi	gr. viij (0.5)
Aquæ destillatæ	f ʒss (2.0)

Heat together, and as soon as the morphine is dissolved and the liquid cooled, add:

Acidi hydrochlorici diluti	f ʒss (2.0)
Chloroformi	f ʒiss (6.0)
Tincturæ cannabis	f ʒj (4.0)
Acidi hydrocyanici diluti	♏xij (0.8)
Alcoholis	f ℥ss (16.0)
Olei menthæ piperitæ	♏xij (0.8)
Oleoresinæ capsici	♏j (0.05).—M.

S.—Five to 15 minims (0.3–1.0) for an adult, in water, every two hours for three doses. More than this quantity is dangerous.

Under the name of *Mistura Chloroformi et Cannabis Indicæ Composita* the N. F. contains a recipe, each fluidram (4 cc.) of which represents about 7 minims (0.45 cc.) of chloroform, 10 minims (0.6) of tincture of cannabis, 2 minims (0.12) of tincture of capsicum, and $\frac{1}{7}$ grain (0.009) of morphine sulphate.

A formula closely allied to this is used in tablet form.

CHLOROFORM.[1]

Chloroform (*Chloroformum,* U. S. and B. P.) was discovered by Guthrie (1831), of Sackett's Harbor, New York, and was first used medicinally (1847) by Simpson, of Edinburgh. Chloroform has an exceedingly hot, burning, sweetish taste. It has a rather agreeable odor, and is very volatile. Its chemical name is trichlormethane. It is soluble in 200 parts of water.

There are two kinds of chloroform—the purified (*Chloroformum,* U. S.) and the commercial chloroform (*Chloroformum Venale*).

If exposed to the light for any length of time, chloroform develops carbonyl chloride, hydrochloric acid, and chlorine, which render it unfit for use. If the acid is present, it will turn blue litmus red; and if chlorine is present, it will form a white precipitate with nitrate of silver. Such impure chloroform may be rectified by shaking it with slaked lime and filtering until the irritating products are gotten rid of. If impure because of improper methods of manufacture, an oily odor will be left on the hand after evaporation takes place. We find, therefore, that chloroform suitable for anesthesia should be transparent and colorless, neutral to test-paper, non-irritating when inhaled, and should evaporate completely when placed on a watch-glass, leaving no residue or odor. It should have a specific gravity not below 1.476, should form no precipitate with $AgNO_3$, should not become brown when heated with caustic potash, and only very faintly brown, if at all, when shaken with concentrated H_2SO_4.

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[1] The student should read the article on Ether in conjunction with this article.

Chloroform vapor in the presence of a gas-flame undergoes certain changes which result in the development of noxious and irritating fumes, consisting principally of hydrochloric acid and chlorine, which produce laryngeal and bronchial irritation. The deleterious effects of these fumes can, however, be neutralized if a cloth or towel wet with aqua ammonia be hung up in the operating-room.

Physiological Action.—Locally applied to the skin, chloroform may produce some tingling and burning even if evaporation be not interfered with. If confined under a watch-glass on the skin, it will cause a blister and act as a counterirritant.

When inhaled, chloroform produces a sensation of warmth in the mouth and throat, a feeling of relaxation, and, finally, unconsciousness. The respirations are at first full and deep, but soon become rapid and shallow. The pulse may be somewhat stronger and fuller for short interval, probably because of mental excitement, but soon fails in strength and becomes more rapid. The irritation produced in the air-passages by its inhalation is slight and no primary arrest of respiration ensues, as is generally seen after ether is first given. The pupils are at first slightly dilated, but are contracted during anesthesia. If *the pupils dilate during the use of chloroform after the contraction just named, danger is imminent and death may suddenly occur.* In some persons the first effects of chloroform are violent struggles, and there is danger in trying to overcome these struggles by pushing the drug very rapidly. Not only is this a well-recognized fact depending upon clinical observations, but Sherrington and Sowton have proved experimentally that the heart is peculiarly susceptible to the depressant effects of chloroform when it is simultaneously exposed to an abnormal quantity of CO_2 in the blood. Further than this Brodie has shown that the rate of absorption of chloroform is greater during the second minute of its inhalation than at any other time and that the volume expired is less during this period. Struggling is particularly apt to be met with in athletes and drunkards. Total muscular relaxation should never be produced by the drug.

Fig. 23.

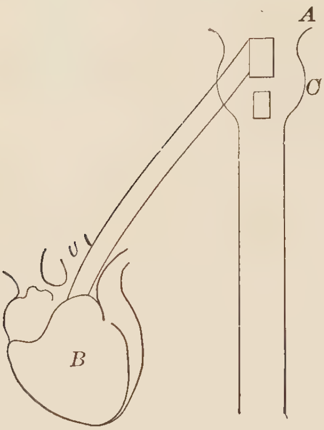

Fig. 24.

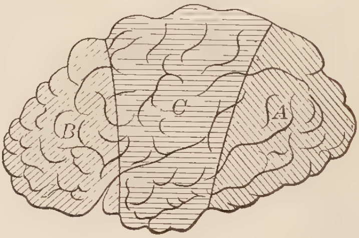

Fig. 25.

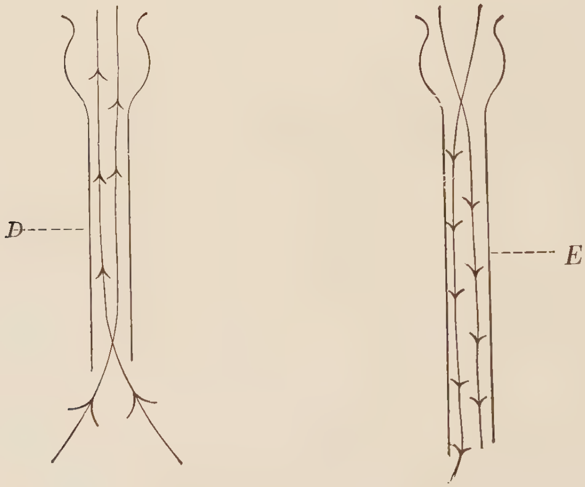

Fig. 23.—*A*, chloroform depresses the vasomotor center; *B*, chloroform dilates the heart and depresses it; *C*, chloroform depresses the respiratory center.

Fig. 24.—*A*, chloroform produces anesthesia by depressing the perceptive centers in the brain and later depresses the (*B*) intellectual centers, and finally depresses the (*C*) motor centers.

Fig. 25.—*D*, depresses the sensory paths in the spinal cord; *E*, finally depresses motor tracts in the cord.

Nervous System.—Chloroform first affects the sensory part of the brain, then the sensory part of the spinal cord, then the motor tract of the cord, then the sensory paths of the medulla oblongata, and finally the motor portion of the medulla, thereby producing death from failure of the vasomotor center and of the respiratory center, unless, as rarely occurs, the heart has already succumbed to the drug. The effect on the sensory portion of the cord may be proved by the experiment explained in Fig. 26.

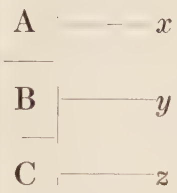

FIG. 26.—Diagram to show effect of moderate doses of chloroform on the sensory paths of the spinal cord. From the area *B*, the pia mater is removed, so preventing the chloroform from reaching it. If the nerve-trunks (*x* or *z*) are irritated, no reflex takes place because the sensory parts are obtunded, but if nerve *y* is irritated, reflexes occur all through the cord because that sensory part is not obtunded, and the motor paths have not been touched.

On the sensory and motor nerves, when locally applied, it acts as an irritant and anesthetic. Upon these nerve trunks. when taken by inhalation, it has little or no effect.

Meyer and Overton believe that chloroform acts as an anesthetic by its great affinity for the lipoid or fatty constituents of the brain cells. The absorption is intracellular and the fat is not removed from the cell.

BLOOD.—Upon the blood in the body chloroform has little or no effect when it is inhaled, except that it decreases the oxygen-carrying ability of the red cells. Shaken with chloroform in a bowl, the blood becomes scarlet in hue.

Buckmaster and Gardner have shown that anesthesia develops in animals when the quantity of chloroform is from 14 to 27 milligrams to 100 grams of blood, and that death ensues when the proportion is 40 milligrams to 100 of blood These investigators also found that the greater part of the absorbed chloroform is held by the corpuscles, the plasma holding very little. Harcourt believes that the quantity absorbed is about one-third of that inhaled.

CIRCULATION AND RESPIRATION.—The effects of chloroform upon these vital functions have been for many years a subject of hot dispute between surgeons and pharmacologists. On the one hand is the school originally led by Syme, of Edinburgh, which has asserted that death or danger from chloroform lies in failure of the respiration and that this was the function to be watched while chloroform was being used; on the other hand, the so-called London school asserted that death arises from cardiac failure and that the pulse is the thing to be watched during the use of chloroform.

The number of clinical and laboratory researches which have been carried out to determine which of these opinions is correct has been very great, both in England and in America, but it has only been within the last forty years that the most competent studies have been undertaken, of which the best known is the series made through the munificence of His Highness the Nizam of Hyderabad in India, and known as the "Reports of the Hyderabad Chloroform Commissions Nos. 1 and 2." The conclusions of the first commission having been criticised adversely because it asserted that the cause of death was respiratory failure, a second commission was formed, and, under a grant of $5000 from the Nizam, Sir Lauder Brunton, of London, was sent out to direct the second investigation. Although a teacher of the theory that death from chloroform is due to cardiac failure, this investigator returned to England converted to the idea that the cause of most of the fatal accidents under this drug is respiratory failure, and the conclusions of Commission No. 2 were also criticised by numerous clinicians and pharmacologists in England and America.

About this time H. C. Wood and the author published a paper in which they expressed their belief in the depressing effects produced by chloroform upon the heart; and MacWilliams, of Glasgow, proved by experiment that chloroform causes cardiac dilatation and enfeeblement. Shortly afterward the author of this book was requested by the government of His Highness the Nizam, through Colonel Edward Lawrie, the Residency Surgeon, to carry out a series of studies[1] designed if possible to reconcile the contradictory results reached by the Hyderabad Commissions and other investigators, and simultaneously Gaskell and Shore in Cambridge University, England, were asked to do likewise.

The result has been to confirm in every way the results of all previous studies in one respect—namely, that the primary action of chloroform on the vital function of circulation is *greatly to depress the vasomotor system,* thereby causing an extraordinary fall of blood-pressure. Gaskell and Shore, to be sure, assert that anesthesia can be produced by chloroform without causing this fall, but the author has never been able to do so (Fig. 27). They also believe that the fall is chiefly a result of cardiac failure. From this view the author dissents, because their experiments upon which these assertions are based were too complex to give practical results; and second, because his own studies and those of others show the vasomotor system to be depressed. There is, of course, some cardiac enfeeblement and dilatation, which add to the fall of pressure.

As with other discussions in medicine, the truth of the question as to whether chloroform causes death by respiratory failure or cardiac failure lies, as it were, half-way between the two antagonistic opinions; and, further than this, the somewhat startling statement may be made that it is not directly due, in the majority of cases, to either of these causes. On the contrary, *the cause of death from chloroform is usually vasomotor depression* whereby the arterioles allow the blood to pass too freely into the great bloodvessel areas which exist in the capillaries and veins, and as a result the man is suddenly bled into his own vessels as effectually as if into bowl. When it is remembered that the capillary network of the body will, with the relaxed veins, hold many times the normal quantity of blood, and when it is remembered that we can inject salt solutions into the vessels to the extent of several times the normal quantity of blood without raising the blood-pressure, it at once becomes evident that the complete vascular relaxation caused by chloroform results in failure of all the vital functions, not because the drug has paralyzed the heart or respiratory center, but because these parts are deprived of blood by its stagnation in the widely dilated capillaries and abdominal veins.

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[1] Therapeutic Gazette, October, 1893.

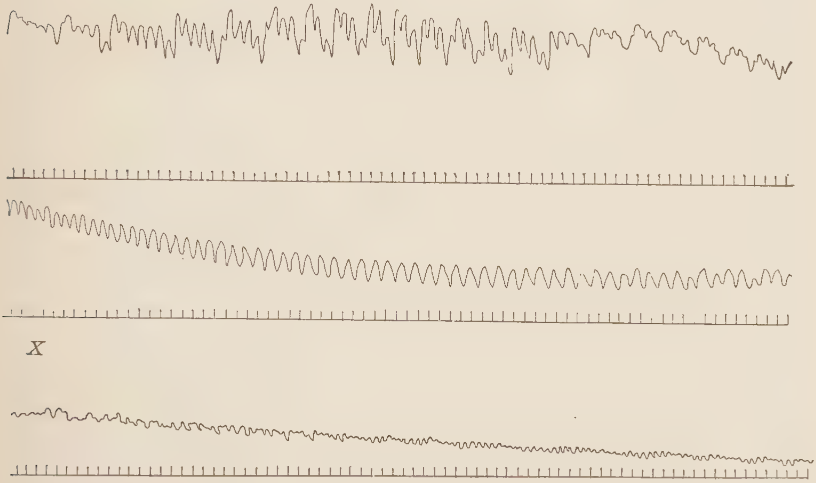

Fig. 27.—Tracings showing the pulse and blood-pressure depressed by chloroform. Note the fall of blood-pressure which begins in the upper tracing and becomes marked in the second tracing. Also notice the weak pulse shown in the third tracing, illustrating the final depressant effect of the drug on the heart. The respiration ceased at X, but the heart continued to beat. The blood-pressure failed first, then the pulse, then the respiration, and last of all the heart stopped. (Reduced from natural size.)

Studies by Leonard Hill on *The Physiology and Pathology of the Cerebral Circulation* show that this is the case, for he asserts that when the blood is no longer flowing to the respiratory centers the heart is still beating, because its coronary arteries, being lower down, are more easily supplied by the small blood stream received by the heart from the veins. These studies are proved by the experiments of the author and his assistant, Dr. Thornton,[1] by every tracing of the Hyderabad Commissions, and all other tracings we have ever seen. Lockhart Mummery has also shown that if a dog is beheaded and pithed, and life maintained by artificial respiration, that it is impossible to stop the heart with chloroform given in an ordinary dose. Even when the air supplied to the lungs was completely saturated with heated chloroform so that the heart was stopped, it could always be revived, showing that it was not truly poisoned or destroyed in function by this drug. We may conclude, therefore, that while chloroform without doubt acts as a powerful depressant poison to the respiratory center and the heart in the same manner as it paralyzes all living protoplasm when applied in excess, that when properly given by inhalation it produces a death equivalent to that resulting from hemorrhage, which is a failure of the respiration not so much from a direct depression of the respiratory center as from its deprivation of blood; and while the tendency of the drug is to depress and dilate the heart, just as it dilates the vessels of which the heart is merely a highly specialized part, the failure in the pulse is due to vasomotor palsy, the patient becoming pulseless because the heart has no blood to pump.

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[1] Therapeutic Gazette, October, 1893.

Let us see what evidence supports this view: First, we have the laboratory tracings of many independent investigators extending over many years and made in all parts of the world, all of which show a fall of blood-pressure. Among these may be named Bowditch and Minot, of Boston; Coats, H. C. Wood, Gaskell and Shore, the Hyderabad Chloroform Commissions; the studies of Wood and the author in 1889 and 1890, and of the author and Thornton in 1892 and 1893. They are confirmed by Hill, who has seen the abdominal vessels engorged with blood under chloroform, the medulla almost bloodless, and the heart still pumping, though respiration had ceased. They are confirmed by the author's own experiments, in which he proved that even after the respiration had stopped and the carotid was empty, the dog apparently dead, it could be resuscitated by visceral compression and artificial respiration, and by inversion, whereby the blood left the dilated abdominal veins for the heart and brain. Again, if a needle was inserted through the chest-wall, the heart was found to be beating, for the needle moved to and fro; and finally if the chest was opened the heart could still be found beating feebly—dilated, it is true, but beating.

So much for the laboratory evidence. What have we in clinical evidence? Equally positive proofs of vasomotor palsy, and none of death being purely cardiac or respiratory. For years Chisolm, of Baltimore, and later Howard Kelly and a large number of others used inversion with compression of the floating ribs in artificial respiration, which forced the blood into the chest and saved life again and again. For years the literature of medicine has teemed with reports of death from chloroform while the patient was sitting up or half recumbent, because the blood-paths being dilated, this posture favored anemia of the vital centers. Again, it has been proved that one of the best vasomotor stimulants—belladonna or atropine—given before the chloroform is used increases the safety of the patient, and that compression of the limbs by bandages does likewise. Recent studies by means of the sphygmomanometer on human beings have also shown a marked fall of blood-pressure when chloroform is inhaled even in moderate amount. Finally, Hill has shown that abdominal compression also aids resuscitation by forcing the blood to the heart. On the contrary, saline transfusion, which would seem to be indicated, is useless, because the dilated blood-paths will receive the saline for a long time before they will overflow toward the heart, for as fast as the fluid flows in they dilate.

The author, therefore, believes that while chloroform in its general depressing power depresses all vital functions, it is the question of blood-pressure which is most important in the healthy individual, although the heart may fail if it be damaged by disease before the drug is used. Embly, too, has shown that when anesthesia is first induced the vagus centers in the medulla are irritated and may arrest the heart temporarily, an arrest which, combined with a sharp fall of pressure, may render the arrest permanent. Therefore, in the use of chloroform, we should always keep the head low, precede its use by atropine hypodermically, bandage the limbs if the case is feeble or already bloodless, and, if necessary, place a compress on the belly and press it deeply into the abdomen, so as to compress the aorta if failure of the circulation develops.

The primary action of the chloroform in medicinal quantities is to depress the blood-pressure chiefly by its vasomotor effect, secondly by its cardiac effect, and, finally, while the drug does exercise a depressant effect on the respiratory center, the failure of this center is partly due to anemia. As an intact respiratory center means regular breathing, we watch this function to determine the dose of chloroform actually inhaled, and because any variation in this function, as shown in irregular breathing, means that the chloroform is disordering arterial tension. Death from chloroform in a healthy organism then is usually a vasomotor death, for an intact arterial system is as important to vital function as an intact cardiac apparatus. When given too freely, or if the heart is diseased, death may be induced by ventricular fibrillation.

TEMPERATURE.—Chloroform when taken by inhalation distinctly lowers the body temperature, probably by aiding in the dissipation of heat and by its action on the nervous mechanism of heat production.

ELIMINATION takes place by the lungs and by the kidneys, and goes on very rapidly, owing to the great volatility of the drug. (See "Effects on Nervous System.")

If large amounts are eliminated by the kidneys, these organs are apt to become irritated and inflamed, but the small quantity necessary to produce anesthesia is without effect on these organs of the healthy.

Antiseptic Power.—Chloroform, when it is added to organic fluids, prevents all changes which depend upon the growth of microörganisms.

Therapeutics.—The first and most important use of chloroform is as an anesthetic, and at this point we come to a question which has been for many years a matter of contention between different sections of the medical profession—namely, as to whether its use is dangerous. In the Southern and Western parts of the United States chloroform is nearly always used, but in the Eastern and Northern portions it is rarely employed. Southerners certainly seem to take chloroform better than Northerners or those living on the Atlantic coast. It is impossible to go into a general discussion of this question here; suffice it to state that even the most enthusiastic supporters of the use of chloroform confess that it is a more dangerous drug than ether if carelessly used, and, while the advantages of chloroform are many, this one great disadvantage overshadows them all.[1] The advantages are—its more agreeable odor and the fact that it does not irritate the air-passages, owing to the small amount necessary to cause anesthesia; the fact that its use is less apt to be followed by nausea and vomiting; the rapidity of its action; and the small bulk which has to be carried by the surgeon. Its disadvantage is—the possibility of its killing the patient.

We come, then, to the all-important questions:

1. Is chloroform a safe anesthetic?
2. Are we to watch the pulse or respiration during the use of the drug, and what are the signs in the respiratory function indicative of danger to the patient?
3. What is the true cause of death from chloroform?
4. Is death from chloroform possible when it is properly administered?
5. Under what circumstances is the surgeon to use chloroform in preference to the less dangerous anesthetic, ether?
6. What is the best way of administering chloroform?

To the first question the answer is, Yes for the majority of cases, provided it is given by one who is skilled in its use, and not only knows how to give it, but also how to detect signs of danger. It is not so safe as ether at any time, other things being equal, and never safe in the hands of a tyro.

To the second question the answer is, Watch the respiration, because as soon as enough chloroform is used to endanger the circulation the respiration will show signs of abnormality either in depth, or shallowness, or irregularity. In other words, the very effect of the drug may be to cause such deep and rapid respirations that an excessive quantity of the drug is taken into the lungs and continues to be absorbed even after the inhaler is withdrawn.

As there is always a fall of blood-pressure under chloroform, it is difficult to feel the radial or temporal pulse, and the respiratory center recognizes the degree of arterial depression which its sister vasomotor center has permttted by finding that its blood supply is insufficient. As respiration fails first, it should be watched first. It is only by watching the respiration that we can tell how much chloroform the patient is getting. We do not watch this function for danger alone, but to determine the dose; for deep respirations, or very rapid ones, mean not only that more vapor is taken into the lungs but that a greater volume of blood is exposed to, and therefore absorbs the drug more freely. Do not forget that a large proportion of deaths occur during the first few minutes of its use.

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[1] The mortality based upon many tens of thousands of cases in which chloroform has been used is about 1 in 2039 (Gurlt); or according to the combined statistics of Julliard and Ormsby, in 676,767 administrations there were 214 deaths—1 in 3162.

Everyone is agreed that the patient taking chloroform should have plenty of fresh air, and in India, to all intents and purposes, patients are operated on in the open air, at least as compared to the closed rooms necessary in America and Europe. This free supply of air is important whether death is believed to be imminent from cardiac or respiratory failure; but this supply of air matters little to the patient if he does not breathe freely, nor does the quantity of chloroform amount to aught if it is not drawn into the lungs. The dose of chloroform is not the amount on the inhaler, but the amount taken into the lungs, and, finally, the amount absorbed by the bloodvessels. The rapidity and depth of respiratory movements is, therefore, as Lawrie asserts, the key to the situation. We withdraw chloroform, as Lawrie says, whenever respiration becomes disturbed in rhythm or when struggling disturbs it, because it is the first indication that the drug's action is uncertain, and because there is no means of determining the dose which is absorbed. While watching the respiration will not warn us of a sudden cardiac arrest in fatty heart plus chloroform depression, neither will the pulse give us such warning; and I am confident that the statement of the Hyderabad Commission, that the *respiration should be watched*, is correct, for I believe, from a series of observations that gradual cardiac failure never occurs without producing respiratory changes from the very first. In other words, I do not believe that in a *healthy* heart chloroform can cause serious disorder without, as a result of beginning disorder, disturbing respiration; and, second, that in the healthy heart a quantity of chloroform sufficient to disorder it will by its direct action disorder the respiration. If, as an extra precaution, one assistant watches the pulse while another watches the respiration, very well, for though the respiration is the more important function to watch, the person watching the pulse might discover an irregularity which the anesthetizer may not see reproduced in the respiratory action; but as divided attention generally means a slighting of both objects in view, Lawrie is right in insisting on the pulse being ignored.

The answer to Question 3 is that death is always due in the healthy person to vasomotor failure accompanied by respiratory depression, the vascular relaxation being severe enough to cause death even if artificial respiration is used skilfully. In the presence of myocardial degeneration or ruptured compensation death may be directly cardiac.

The answer to Question 4 is, Yes. The physician having a case of heart disease requiring surgical interference should remember, that anesthesia always means an approach to death even in the healthiest of men. In the event of a death under chloroform the physician is blameless if he has taken suitable preliminary precautions and given the chloroform properly.

To Question 5 I have several answers to make:

1. Chloroform may be used in hot climates (when ether is inapplicable), where a free circulation of air increases the safety of the patient.

2. Chloroform may be used whenever a large number of persons are to be rapidly anesthetized, so that the surgeon may pass on to others and save a majority of lives, even if the drug endanger a few, as on the battlefield, where only a small bulk of anesthetics can be carried.

3. The employment of chloroform is indicated in cases of Bright's disease requiring the surgeon's attention, owing to the fact that anesthesia may be obtained with such a small quantity of the drug that the kidneys are not irritated, whereas ether, because of the large quantities necessarily used, would irritate these organs. Quantity for quantity, ether is, however, the less irritant of the two.

4. In cases of aneurism or atheroma of the bloodvessels, where the shock of an operation without anesthesia would be a greater danger than the use of an anesthetic, chloroform is to be employed, since the struggles caused by ether and the stimulating effect which it has on the circulation and blood-pressure might cause vascular rupture.

5. In children or adults who already have bronchitis, or who are known to bear ether badly, or, in other words, have an idiosyncrasy to that drug, chloroform may be employed.

Other indications for the use of chloroform in preference to ether are in the performance of brain surgery, where ether is apt to produce meningeal congestion by vomiting. In performing tracheotomy, if the case is urgent and the ether produces respiratory irritation, chloroform may be used with advantage.

Chloroform inhalations have been recommended in *excessive chorea* and in *puerperal convulsions*. As the liver is often already disordered in its function and as chloroform acts deleteriously upon this organ, many persons believe chloroform should not be used in such cases but full doses of morphine used instead. Chloroform is also a valuable agent in the *reduction of hernia*, owing to the muscular relaxation produced.

Sometimes a few whiffs will put a nervous patient to sleep, but its use as a hypnotic is very dangerous, as it may produce a habit, and the habit is apt to end fatally, but I have had under my care a feeble old woman of nearly seventy years, who used for years about $\frac{1}{2}$ ounce every night, by inhalation, to allay cough.

Parturient women seem able to take chloroform with more safety than other women. There are four important factors in lessening the danger of chloroform in this class of cases: 1. Less chloroform is given than is usual in surgical operations. 2. The pregnancy may produce immunity by reason of the slight cardiac hypertrophy produced at this time. 3. The absence of fright, for the woman welcomes the anesthetic. 4. The frequently recurring pains of labor so stimulate the vasomotor center that the dominant action of chloroform—namely, vasomotor depression—is combated.

In severe *whooping cough* a few drops of chloroform may be poured on the back of the hand of the attendant and the hand held before the child's face. While the child may at first dislike the odor of the drug, the relief given soon teaches the patient its value, and he will ask for it when he feels the attack coming on. If the attack is prolonged and violent, this treatment must be used with caution, owing to the strained condition of the heart-muscle, which may be still further depressed by the frequent use of the drug. The drug should not be poured on a cloth, but on the back of the nurse's hand. In this way too much of it cannot be given to the patient at one time.

Before considering the actual administration of chloroform by inhalation the contraindications to its use must be recalled. Some of these are as follows:

1. A condition of shock due to trauma or recent severe surgical procedure, because in shock the blood-pressure is low and chloroform exaggerates this state.
2. Obese persons, particularly if the belly walls are relaxed and flabby, because diaphragmatic action is usually impaired.
3. Partial or complete starvation, with special reference to carbohydrates, as in cases of prolonged vomiting, in eclampsia and in diabetes mellitus, because these states tend to acidosis and so does chloroform, which is also prone to deleteriously affect the liver.
4. Children who are subject to cyclical vomiting, because these patients usually have a small reserve of glucose in the liver and readily develop an immediate or late acidosis. (See Untoward Effects.)
5. A condition of lymphatism or persistent thymus, conditions usually met with in children.
6. Evidences of myocardial degeneration or severe fatigue, or the presence of well-advanced cardiovascular-renal disease. A well compensated valvular lesion is not a contraindication.

Whenever it is possible, the physician should carefully study the general condition of the patient for several days before chloroform is given. If time, and the state of the digestion permits, care should be taken that the liver and muscles are well stored with glycogen by the free use of carbohydrate foods up to twenty-four hours before the drug is given. By this means the liver is protected from the harmful effects of chloroform and the patient has a reserve of nourishment to carry him through postoperative starvation.

If there is urgency for the use of chloroform it is best to use levulose as it enters the liver more rapidly than does glucose.

A correct conception of the circulatory state is most important for various reasons. It is usually wise, if time permits, to give the patient several days rest in bed when the cardiac state is doubtful and to give small tonic doses of tincture of digitalis, say 10 minims (0.65), and the same amount of tincture of belladonna, two or three times a day and to precede the administration by $\frac{1}{100}$, or more, of atropine by hypodermic injection, since by this means relaxation of the splanchnic vessels is combatted.

Strychnine should not be used before operation as it tends to increase shock, but it may be employed after operation with atropine to combat shock already induced. Adrenalin is not to be used before nor while chloroform is used as it tends to induce ventricular fibrillation.

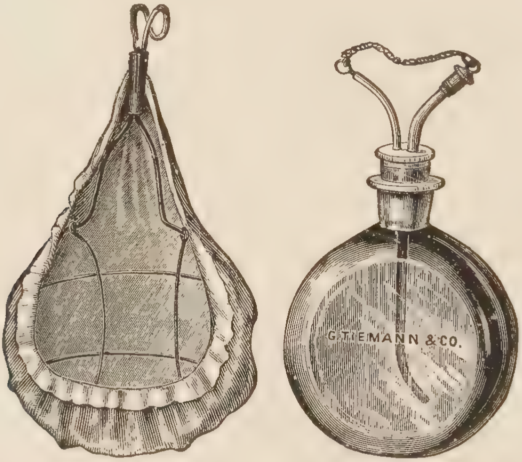
G. TIEMANN & CO.

Fig. 28.—Esmarch's inhaler and chloroform bottle. The inhaler consists of a wire frame covered by a piece of thin flannel.

Administration.—When chloroform is given it should be poured drop by drop upon an Esmarch inhaler, or upon a folded napkin or towel, in which case the cloth should then be held about 3 to 6 inches from the mouth and nose, so that the vapor may be thoroughly mixed with air in the proportion of 2 per cent of vapor to 98 of air; 0.5 per cent does not cause unconsciousness and 5 per cent is dangerous. The British Special Chloroform Committee (1910) points out that in grave disease and feebleness less than 2 per cent should be used to avoid danger, and in persons of this type even so low a percentage as 0.5 will prove efficient. The percentage to be used is that which is adequate and does not exceed 2 per cent. Two per cent should not be exceeded at any time during its use. The character and form of the material used to cover the inhaler or to hold the chloroform is of greater importance than would appear at first sight. Thus, a single layer of flannel, although it holds less chloroform than will several layers, nevertheless may provide the patient with a greater amount of chloroform, because under these conditions the air is drawn through the meshes of the flannel instead of over its surface, as it is when the several thicknesses prevent the through-and-through passage of air. Again, the degree to which chloroform spreads when poured on different fabrics is of some interest. It spreads more rapidly over loosely woven cloths than over tightly woven ones, and so exposes a greater surface for vaporization and permits a greater dose of chloroform per inhalation not only by this means, but by the fact that air is readily drawn through its meshes.

The anesthetist should never permit himself to hurry the patient under the effect of the drug nor should he permit any preliminary measures or the primary incision to be made until the patient is well under. Many deaths have resulted from carelessness in these particulars.

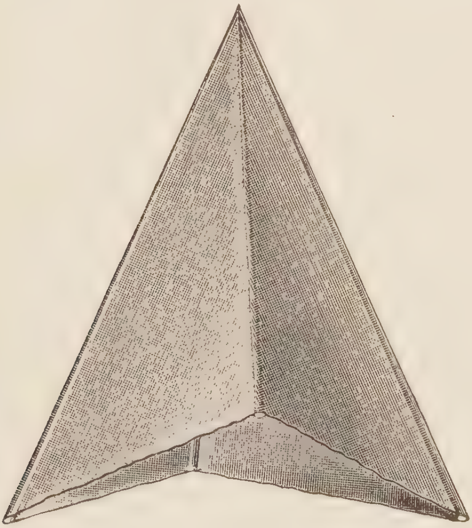

FIG. 29.—Lawrie's collapsible inhaler, made of four small pieces of bamboo covered with muslin. The chloroform may be dropped on the sides of the inhaler.

The administration must be gradual, as "pushing" the anesthetic is dangerous, because the lungs deliver to the left side of the heart an excess of the drug, and this passes directly into the coronary vessels and to the vital centers in the medulla. The best way to use the drug is by means of a "chloroform dropper ampoule," which is so constructed that it falls upon the inhaler drop by drop.

The safest method of administration is by Esmarch's or Lawrie's inhaler, because these provide a free circulation of air and the attention of the anesthetizer is not distracted from the respiratory movement by the manipulation of complicated apparatus.

The dangers of chloroform seem to be considerably decreased by the simultaneous administration of oxygen gas with the anesthetic vapor. (For the best method of using oxygen and chloroform together see Oxygen, Important.)

The author largely agrees with Lawrie's published conclusions, which are as follows with slight modifications:

1. The chloroform should be given on absorbent cotton, stitched in an open cone or cap.

2. To insure regular breathing, the patient, lying down, with the clothing loose about the neck, heart, and abdomen, should be made to blow into the cone, held at a short distance from the face. The right distance throughout the inhalation is the nearest which does not cause struggling or choking or holding of the breath.

3. The administrator's sole object while producing anesthesia is to keep the breathing regular. As long as the breathing is regular and the patient is not compelled to gasp in chloroform at an abnormal rate, there is comparatively little danger.

4. Irregularity of the breathing is generally caused by insufficient air, which causes the patient to struggle or choke or hold his breath. There is little or no tendency to either of these untoward effects if sufficient air is given with the chloroform. If they do occur, the cap must be removed and the patient allowed to take a breath of fresh air before the administration is proceeded with.

5. Full anesthesia is estimated by insensitiveness of the cornea. It is also indicated by stertorous breathing or by relaxation of the muscles. Directly the cornea becomes insensitive or the breathing becomes stertorous inhalation should be stopped. The breathing may become stertorous while the cornea is still sensitive. The rule to stop the inhalation should, notwithstanding, be rigidly enforced, and it will be found that the cornea always becomes sensitive within a few seconds afterward.

Individuals who are robust and strong and who struggle violently are in greater danger from the use of chloroform than the sickly and weak, probably because the struggles cause deep inhalation of the drug, exhaust the vasomotor system, strain the heart and tend to dilate its walls.

Above all, it is necessary to remember the fact that a person having taken chloroform twenty times before does not show he is not in danger on taking it the twenty-first time; and it is also to be borne in mind that many of the sudden deaths from chloroform have occurred during the first stage of the inhalation of the drug before consciousness has been lost, and, therefore, when an accident was least expected.

In operations about the mouth chloroform may be employed by passing a soft catheter through the nose and then by means of a hand-bulb attached to a small wash-bottle containing chloroform, or by means of a Junker inhaler, introducing into the post-nasal spaces chloroform vapor mixed with air.

The question has arisen a number of times whether it is possible to chloroform a person who is asleep without his being awakened. This has been decided by numerous tests to be possible, particularly if the sleep be heavy.

Before closing the consideration of the use of chloroform for anesthetic purposes mention should be made of the so-called anesthetic mixtures. Of these the A. C. E. is the best known. It consists of a mixture of 1 part of alcohol (sp. gr. 0.838), 2 parts of chloroform (sp. gr. 1.497), and 3 parts of ether (sp. gr. 0.735). Billroth's A. C. E. mixture is composed of chloroform 3 parts, and ether and alcohol 1 part each. The Vienna mixture consists of 1 part of chloroform and 5 of ether, and the so-called methylene mixture in 30 per cent methylic alcohol, and 70 per cent chloroform. The object of all these mixtures is evident—namely, to get the anesthetic effect of the ether and chloroform without the cardiac and respiratory effect of either, and the alcohol when added is to act as a stimulant which it never is. As the volatility of each ingredient varies, the mixture is futile, for the ether evaporates first, and the chloroform next, and the alcohol last. The A. C. E. is popular in England, but not in the United States.

A brief anesthesia for dressing painful wounds and burns may be induced by the following mixture largely employed in the World War: Ethyl chloride 5 cc. chloroform 1 cc. ether 24 cc. This quantity is placed on flannel and put over the patient's mouth and nose with a piece of dry flannel over it, and this again is covered by oil silk in which is a hole for the nose. Anesthesia starts with the second breath and lasts for about ten minutes.

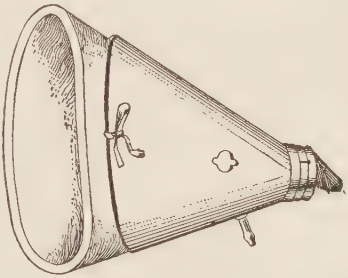

Fig. 30.—Krohne and Seseman's modification of Lawrie's inhaler, with feather respiration-indicator attached. The inner lining is of white felt, the outer case is of leather. The chloroform may be poured on the felt through a small hole in the leather on the top of inhaler.

Chloroform, when taken internally by the mouth, causes a sensation of warmth in the stomach and a hot, burning taste about the lips and buccal mucous membrane. In overdose it has produced death when taken in this manner. Comparatively rarely used in internal medicine, chloroform in the form of the spirit of chloroform (*Spiritus Chloroformi*, U. S.) or water of chloroform (*Aqua Chloroformi*, U. S.) is useful in cough mixtures, which are given to persons having an irritative *cough*, and in cases where, through nervousness or other cause, tickling in the throat or bronchial tubes keeps the patient continually in a state of unrest. (See Bronchitis.)

In *gastric* or *intestinal flatulence* 3 or 6 minims (0.15–0.3) of pure chloroform, or 30 to 60 minims (2.0–4.0) of the spirit of chloroform, will often give relief. The following prescription is useful in all forms of abdominal pain and is harmless in ordinary dose:

℞—Spiritus chloroformi		f℥ss (16.0)
Spiritus camphoræ		fʒij (8.0)
Tincturæ lavendulæ compositæ	q. s. ad	f℥iij (90.0).—M.

S.—Dessertspoonful (8.0) in water every twenty minutes for four doses.

In the treatment of *serous diarrhea* the spirit of chloroform when combined with astringents and opium is most useful, provided that the irritating cause is first removed. In *renal* or *hepatic colic* a few inhalations, not sufficient to disturb consciousness, will not only give temporary but sometimes permanent relief by relaxing spasm. Rubbed on the chest in the form of chloroform liniment, this drug will sometimes prevent *asthmatic attacks,* but chloroform ought not to be inhaled, except most carefully, in this affection, because of the strained condition of the right side of the heart.

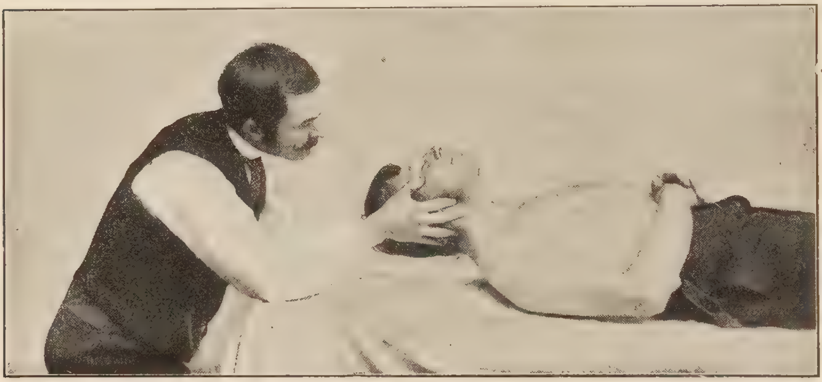

Fig. 31.—Showing the attitude in which the head should be held to permit the easy passage of air through the glottis. This position raises the epiglottis and lifts the soft palate from the tongue. (Martin and Hare's method.)

In dram (4.0) doses chloroform has been used as a remedy for *tapeworm,* but ought never to be so employed.

When placed in liniments of a stimulating character chloroform is a very useful application over muscles affected by soreness and stiffness, as in *lumbago* and *gout,* and chloroform liniment may also be used over *neuralgic areas* for its local anesthetic effect.

Untoward Effects and Their Treatment.—Vomiting after the use of chloroform develops in about 15 per cent of cases. Alarming effects produced by this drug are far more apt to appear in males than in females, the relative proportion being about 6 to 1. Sometimes during the administration of chloroform the heart or respiration suddenly ceases, and in some cases this change is preceded by a peculiar shade or cloud which passes over the face of the patient; but death may come suddenly and without warning. If untoward effects appear, the anesthetic must be at once withdrawn and artificial respiration resorted to. Injections of ether and brandy should be given beneath the skin, and the poles of a battery with a rapidly interrupted current *swept over the body*, but not held over the phrenic nerve or diaphragm.[1] The patient must be held head downward, so

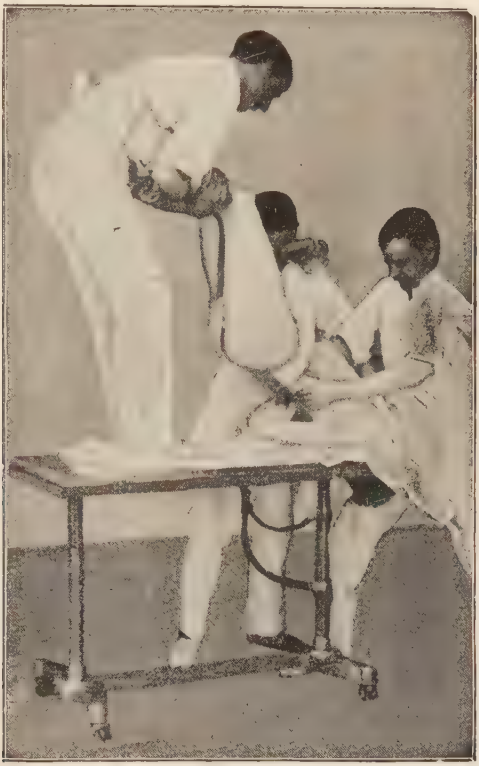

FIG. 32.—Showing the inversion of the patient as adopted by Kelly, and the method of performing artificial respiration simultaneously. The chest is expanded by drawing its lower segment toward the operator.

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[1] While few text-books give any specific directions concerning the practical application of the methods which are to be employed in such emergencies, those that do so force the physician to a procedure at once dangerous and impractical; for the directions usually given are, to place the positive pole of the battery on the phrenic nerve as it crosses the anterior scalene muscle at the root of the neck, the negative pole being pressed against the lower margin of the ribs. A rapidly interrupted current is now to be used with the purpose of causing contraction of the diaphragm by the direct action of the electricity upon the nerve. Even theoretically this is a possible source of danger, and practically the writer has proved danger to be ever present under such treatment. The cardiac inhibitory nerves run so closely to the phrenic fibers, and respond so readily to electrical stimulation, that it is difficult to imagine how they can escape stimulation if a current be used of sufficient strength to excite the phrenic nerves near by. By practical experiment the writer has proved that inhibition of the heart may not only be possibly brought about by this method, but also that it is nearly impossible to avoid such an effect if the phrenics are to be reached.

that the blood will flow to the brain, as Leonard Hill and the author have shown that the chief cause of death is vasomotor relaxation with accumulation of the blood in the abdominal vessels. Bandages should be applied to the limbs and compression, by means of a bandage and large compress, be exercised on the abdominal contents, and active artificial respiration practised for a long period of time as the most important measures for the patient's relief. External heat should be applied. Atropine, strychnine, caffeine, and digitalis may be used to stimulate the heart and respiration. Of these, strychnine is the most valuable. (See directions under the article on Ether.) If the patient is breathing oxygen gas should be freely given by inhalation and accompanied by 5 per cent of carbon dioxide to stimulate the respiratory center to greater effort. (See Carbon Dioxide.) *Adrenalin chloride* is *contraindicated in that it increases the danger of ventricular fibrillation* particularly if the anesthesia is light. (See Suprarenal Gland.)

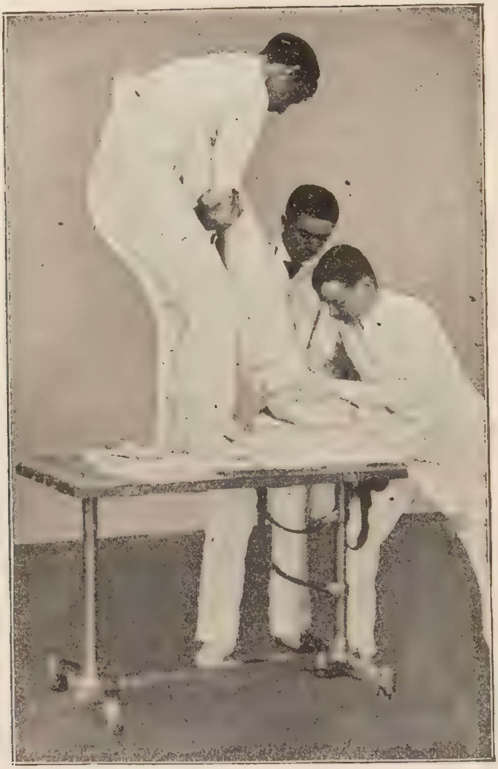

FIG. 33.—Same as Fig. 32, except that the floating ribs are compressed to expel the air from the chest.

In addition to the movements of artificial respiration, the tip of the tongue may be grasped by a pair of forceps and drawn out of the mouth and upward from ten to fourteen times a minute, in order to stimulate the diaphragm. (See Asphyxia, Part IV, for detailed directions.) In a number of cases patients apparently dead from chloroform have been resuscitated by repeated massage of the precordium, and even by incising the abdominal wall and massaging the heart through the diaphragm.

The measures adopted for resuscitation should not be stopped for at least one hour, as individuals have recovered as long as this after an accident from chloroform.

Ostertag has found that very prolonged inhalations of chloroform in the lower animals produce widespread fatty degeneration.

Caspar, in 1850, and, more recently Guthrie, in England, and Bevan and Favill, in America, and an increasing number of other observers have published researches in which they found that anesthetics, especially chloroform, can produce a destructive effect upon the cells of the liver and kidneys, and on the cells of the heart and other muscles, resulting in fatty degeneration and necrosis, very similar to the effects produced in phosphorus poisoning. These changes are most marked in the liver. Further, they are in direct proportion to the amount of the anesthetic employed and the length of the anesthesia; and again, certain individuals exhibit an idiosyncrasy or susceptibility to this effect of chloroform. Of the predisposing causes, they find that children are more susceptible than adults; that conditions of lowered vitality, such as diabetes, infections, and intoxications, predispose to it, and, indeed, any condition which tends to produce exhaustion, as do also sclerotic changes in the liver and kidneys. As a result of this fatty degeneration of the muscle and liver cells, toxins are produced which are ordinarily eliminated, but which in certain cases are retained, and these toxins produce a definite chain of symptoms which appear in from 10 to 150 hours after the anesthesia, and consist in vomiting, retching, delirium, convulsions, coma, Cheyne-Stokes respiration, cyanosis, jaundice, and usually death. A certain number of mild cases are met with in which a transient jaundice occurs and in which recovery takes place. Bevan and Favill consider that the hepatic changes are as definite as those found in the pancreas in acute pancreatitis, and that, as by-products in this toxemia, but not as the essential poisons, are found acetone, diacetic acid, and beta-oxybutyric acid in the blood and urine. They assert that the damage to the liver may be so great as to cause a total destruction of this organ, and they state that this serious and evil late effect of chloroform, which has heretofore not been generally recognized, must still further limit the use of this powerful and dangerous agent. They believe that diabetes, sepsis, starvation, hemorrhage, and fatty degeneration contraindicate the use of chloroform, and that the possibility of this condition arising also militates against the employment of chloroform in prolonged operations, particularly in children. If acetone is found in the urine, the use of chloroform is contraindicated.

When acetonuria is found after the use of chloroform, the patient should be treated as if he had diabetic acetonuria. (See Diabetes.) Levulose may also be used in doses of ½ ounce (15.0) in water by the stomach, after this viscus has been washed out with a solution of sodium bicarbonate, and by the Murphy drip. A dram in 5 per cent strength is the gastric dose of levulose for a child. If the state is very urgent, the levulose may be given intravenously in normal salt solution. (See Levulose, Diabetes and Insulin.)

There can be no doubt that the danger of acidosis resulting from the use of chloroform is greatly increased by starving the patient before the anesthetic is given, and it has been proved that the use of easily assimilated or predigested starchy foods shortly before the production of anesthesia probably greatly decreases the danger of this grave complication, just as full amounts of carbohydrate food are indicated in cases of diabetes threatened by diabetic coma.

Local Use and Internal Administration.—The official preparations of chloroform are a liniment (*Linimentum Chloroformi*, U. S. and B. P.), a water (*Aqua Chloroformi*, U. S. and B. P.), dose ½ to 2 ounces (16.0–60.00); a spirit (*Spiritus Chloroformi*, U. S. and B. P.), the dose of which is 20 minims to 1 fluidram (1.3–4.0). The B. P. recognizes, besides those given, *Tinctura Chloroformi et Morphinæ Composita*, dose 5 to 15 minims (0.3–1.0).

CHROMIUM TRIOXIDE.

Chromic acid (*Chromii Trioxidum*, U. S.; *Acidum Chromicum*, B. P.) is not a true acid. It should never be mixed with sweet spirit of nitre, strong alcohol or glycerin, or *any organic matter*, as under these circumstances an explosion may result.

Therapeutics.—Chromium trioxide is used solely as a caustic for the destruction of *growths on the skin* or *mucous membranes*. When a limited area is to be destroyed, a small crystal is placed on the part to be cauterized; but if a larger area is to be attacked and severe action is required, the liquid resulting from its deliquescence on exposure to the air may be employed by means of a glass rod. The surrounding tissues should always be protected with lard or adhesive strips.

J. William White has recorded a death from the application of chromium trioxide to a large number of condylomata about the buttocks and vulva. Where the drug has been swallowed, the patient should be treated for gastro-enteritis, and dilute alkalies and lime-water be used, as well as emetics and demulcent drinks.

If a superficial action is desired, a solution containing 100 grains to the ounce (6.6–30.0) of water is sufficient, and for small warts and similar growths this solution will be found sufficiently strong.

Liquor Acidi Chromici, B. P., is composed of 1 part of acid to 3 of water.

CHRYSAROBIN.

Chrysarobin (*Chrysarobinum,* U. S. and B. P.) is sometimes misnamed chrysophanic acid, and is a yellow, tasteless powder, soluble in solutions of alkalies, in acids and in ether.

Therapeutics.—Chrysarobin is given internally in the dose of $\frac{1}{8}$ grain (0.008) in *psoriasis* and *parasitic diseases* of the skin, but more commonly is employed externally in the form of the official ointment (*Urguentum Chrysarobini,* U. S. and B. P.) which is too strong for direct use, and should be mixed with 4 or 5 parts of benzoated lard before application to the skin. Even when so diluted, chrysarobin may cause great swelling and inflammation of the skin, with desquamation of the cuticle. Should the surface be broken, the drug may be absorbed and cause vomiting. As chrysarobin stains the skin a dark brown, it ought not to be used on the face; but should this accident occur, the discoloration may be removed by the application of a weak solution of chlorinated lime. In *psoriasis* the following may be employed after the patient has taken a bath to soften the scales:

℞—Chrysarobini . . . . ʒj (4.0)
Ætheris,
Alcoholis . . . . āā q. s. ut ft. sol.
Collodii . . . . f℥ij (60.0).—M.
S.—Apply with a brush to the part affected.

CIMICIFUGA.

Physiological Action.—In large doses Cimicifuga (*Cimicifuga,* U. S.) paralyzes the sensory side of the spinal cord of the lower animals, and in consequence lowers reflex activity. It has no effect on the nerves and muscles. On the circulation the drug acts by depressing the heart and vasomotor system. Death is due to respiratory arrest. In small dose it is a feeble cardiac stimulant. When full medicinal doses are given to man it nearly always produces frontal headache. Its known physiological effects have no direct bearing upon its use in medicine.

Therapeutics.—Cimicifuga has had an excellent reputation as a remedy in *chorea,* particularly if the patient is otherwise in good health, but it should be used with careful attention to the regularity of the bowels and often be accompanied by iron. It is also indicated when there is, in addition to St. Vitus's dance, a rheumatic tendency. In *chronic bronchitis* it is asserted to be of value, and in *rheumatism* of a subacute or chronic type cimicifuga sometimes gives relief.

Cimicifuga has been highly praised in the treatment of *neuralgia,* particularly of the ovarian type, and in *amenorrhea, subinvolution and tenderness of the womb.* To women who state that they cannot step off a step without paining or hurting the uterus or ovaries cimicifuga often gives relief. There can be no doubt that it is an active uterine stimulant, and it should be used with caution during pregnancy for fear of abortion. There are, however; some practitioners who commend its use for the prevention of this accident. By reason of this power it may be employed instead of ergot during labor, and is said to be better in some cases, because it produces normal, not tonic contractions. As a matter of fact, it is little used for this purpose. In the treatment of *headache* arising from overstraining of the eyes cimicifuga is said to be beneficial.

The extract (*Extractum Cimicifugæ,* no longer official) is given in dose of 1 to 5 grains (0.06-0.3), the fluidextract (*Fluidextractum Cimicifugæ,* U. S., the dose of which is 10 to 30 minims (0.6–2.0) or even 1 dram (4.0).

CINCHONA.

Cinchona, U. S., is the dried bark of *Cinchona ledgeriana* and other cinchonas (Fam. *Rubiaceæ*), and contains several alkaloids.

The alkaloids of the quinine series derived from these barks are quinine or quinina, quinidine or quinidina, and quinicine, which is an artificial alkaloid. Of the cinchonine series we have cinchonine, cinchonidine, and cinchonicine, which last is also an artificial alkaloid. Besides these alkaloids there are present kinic and kinovic acids and other inert and useless substances.

As quinine is the most important of the group, and as its physiological action is virtually identical with that of the rest, whatever is said hereafter in this article refers to quinine unless otherwise stated. All the alkaloids of cinchona which have been named are not employed as pure alkaloids, but as salts formed by adding sulphuric, hydrochloric, or other acid to increase their solubility.

Physiological Action.—When quinine is taken in overdose, it causes ringing in the ears, dizziness, disorders of taste and smell, disturbance of vision in some cases, and fulness in the head. Deafness often comes on, and is generally, with the roaring in the ears, the most annoying symptom. Headache is not uncommon. (See Untoward Effects.)

NERVOUS SYSTEM.—Upon the cerebrum quinine acts as a stimulant, and finally as a congestant if given in excessive dose. If poisonous doses are used, intense cerebral congestion ensues, and finally unconsciousness comes on.

CIRCULATION.—If quinine, even in small amount, be injected into the jugular vein of a dog, so that it goes in concentrated form to the heart, cardiac paralysis will result. If this does not occur, the drug simply decreases pulse-force, pulse-rate, and arterial pressure. When given to man in small medicinal doses by the mouth, the drug acts as a general stimulant to the entire body, and so tends to support the circulation, increasing to a slight degree the pulse-rate and blood-pressure. If the dose by the mouth be very large (15 grains), the pulse is depressed. Full doses in fever therefore act as vascular sedatives. (For the action of quinidine on the heart see Therapeutics.)

Blood.—After poisonous doses the blood is more coagulable than normal, but in medicinal amounts no such effect is produced. The effect of quinine on the blood corpuscles is of great interest. Even in full medicinal doses it arrests diapedesis of the white cells from the capillaries by a direct action on these cells, and if the drug be applied to the mesentery of a frog the cells already extruded cease their movement, but the intravascular cells do not. On the other hand, if quinine be given internally in so small a dose that the proportion to the blood is as 1 to 20,000, the white cells in the vessels cease to migrate, but those cells in the surrounding tissues do not (Binz, Hare, Disselhorst, Ikeda). It is stated, however, that this is not the case with all animals. This is perhaps the explanation of the effects of quinine in acute inflammations, for it arrests inflammatory exudation and allows the extruded cells to wander from the diseased area. Wilson and also Mainwaring and Ruh have shown that small doses of quinine equalling 2 to 3 grains of the sulphate distinctly increase the phagocytic power of the blood, and that very large doses, more than 4 grains, circulating in the blood, distinctly decrease this power. This is another scientific confirmation of the belief of many practitioners that quinine aids the body in combating infections. Medicinal amounts gradually increase the number of red blood corpuscles.

Respiration.—The effect of quinine on this function is so slight that it is practically *nil*.

Temperature.—Quinine lowers body temperature in health very little if at all, and in fevered states its influence is governed by the cause of the fever. Thus in malarial fevers quinine is a powerful indirect antipyretic, by reason of its powers over the infection, and not because it has any influence over heat production and dissipation.

Absorption.—Quinine is absorbed from the stomach and duodenum where it is dissolved by the bile, not from the lower intestine, where it is precipitated by the alkaline juices of the bowel. For this reason it should be given in cachet, capsule, or powder, rather than in compressed tablet, so that it may be absorbed before it reaches the jejunum. Pills should be freshly made.

Kidneys, Elimination and Tissue-waste.—Quinine escapes from the body chiefly through the kidneys, although some of it is destroyed by oxidation in the liver and tissues. In the urine it is found as quinine and as dihydroxyl quinine. The excretion of quinine is by no means rapid. Thus Jeanselme and Dalimier have shown that when it is given intravenously it appears in the urine at once and is present in this fluid for approximately twenty-seven hours. When given intramuscularly it appears in fifteen minutes and continues present for fifty hours, and given by the mouth it appears in the urine in twenty-five minutes and persists for thirty hours. This test can be made by means of Tanret's solution[1] if the urine is filtered and does not contain albumin, and will respond in the presence of $\frac{1}{100}$ mg. Ten cc. of urine are placed in a test-tube and the reagent added drop by drop. The urine containing quinine, or its derivative, becomes opalescent, then opaque and finally flocculi are deposited.

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[1] Tanret's solution is composed of potassium iodide 3.32, mercuric chloride 1.35, acetic acid 20 and distilled water 64.

Upon tissue-waste quinine acts as a depressant and decreases the elimination of nitrogenous materials.

DIGESTIVE TRACT.—Quinine has a bitter taste in as small a proportion as 1 to 10,000 of water. Upon the stomach it acts as a tonic and stimulant, but if given too frequently, or in large doses, it may irritate this viscus. Moderate doses are slightly constipating, and very large doses may induce colicky pain.

Poisoning and Untoward Effects.—Severe poisoning from quinine rarely occurs, except in persons who have an idiosyncrasy to the drug. Roberts has recorded the case of a woman, aged thirty-six years, who took 5 drams (20 grams) and survived, after suffering from deep coma, shallow breathing, slow pulse, absolute deafness, and blindness. The loss of sight lasted two weeks, but the retinal changes persisted for several months. Death from an overdose of quinine is exceedingly rare. The cases in which death has followed its use are medical curiosities. Bouchardat has recorded the case of an adult male who died as a result of taking from 45 to 65 grains of the drug. That this was the real cause of death is doubtful. Soullier quotes Tarnier and Budin as asserting that enough quinine may be eliminated by the milk to produce death in a nursling. This seems hardly possible.

"Untoward effects" is the best term with which to qualify the disagreeable symptoms which sometimes come on in persons having an idiosyncrasy to the drug and who are in reality poisoned by small doses. In these cases, sudden, complete, but temporary blindness is met with. De Schweinitz has seen it occur after a dose of 15 grains given in divided doses during twenty-four hours. He has also shown that in dogs quinine produces in continued toxic doses constriction of the retinal arteries, and permanent optic atrophy; and Holden has proved that there is degeneration of the nerve fibers and ganglion cell-layers of the retina. When the dose is a single one recovery of vision usually occurs, but if the quinine has been continued after the symptoms appeared the prognosis is not favorable. In other instances complete deafness asserts itself, due to congestion of the middle ear, while skin eruptions, generally of the nature of erythema, are not rarely seen. In other instances petechial and vesicular eruptions are developed, and swelling of the gums with a tendency for them to bleed may appear (Schulz). After lethal doses hemorrhage into the middle ear may be found, and severe epistaxis may ensue after so small a dose as 4 grains (0.25). The buzzing in the ears can generally be relieved by the administration of 10 grains (0.60) of bromide of sodium combined with a little ergot. Karamitsas has stated that quinine may produce hemoglobinuria in persons suffering from malarial poisoning, and apparently may even develop bilious remittent fever.[1] (See below.) Irritability about the neck of the bladder may sometimes be produced by quinine, particularly in children.

Therapeutics.—Quinine is employed in medicine to fulfil one great office, although its influence in other directions is by no means slight, namely, to destroy the malarial parasite. It may also be employed as an *antipyretic,* and as a *tonic* possessing peculiar virtues.

For many years physicians employed this drug empirically, not knowing the cause of the disease called malaria. We now know that the theory of Binz, advanced as long ago as 1867, is correct, and that malaria is due to the presence of a parasite, the *plasmodium malariæ,* which was first accurately studied by Laveran and named by Marchiafava and Celli. These and other investigators have found that quinine acts as an active poison to these parasites, even in so weak a solution as 1 to 20,000. The effect of quinine upon the three forms of the malarial parasite has been studied by a number of investigators, chiefly by Romanowski, Mannaberg, Marchiafava, and our own Craig (U. S. Army). Craig states that if quinine is given when the young intracorpuscular parasites of the tertian variety are present there at once follows a great increase in amœboid movements, followed in an hour by an arrest of this movement. The parasite now becomes ring-shaped, or spherical, and much more sharply outlined than in the parasite not affected by the drug, and its protoplasm becomes very refractive and granular. In those parasites which succeed in advancing to the stage of segmentation in spite of the quinine the young segments undergo fragmentary degeneration. The effect of quinine upon the full-grown tertian parasite before segmentation takes place is to cause the organism to shrink, to become granular, and the pigment bodies to become motionless. An important practical therapeutic fact is that if one large dose is given just before a chill it destroys many of the young parasites, but if not all these then those which escape rapidly attack new blood cells; whereas if repeated doses of quinine are given every three or four hours all the parasites are destroyed.

When the quartan parasite is attacked by quinine the same quickening of amœboid movement, followed by arrest and by fragmentation and granular degeneration, ensues, but the young parasites seem to be more susceptible, so fewer escape than in the case of the tertian organism.

As to the estivo-autumnal parasite, Craig states that the hyaline or "ring" forms become very much more refractive and sharply defined under the effect of quinine. Their amœboid movements are greatly increased and they move rapidly from one place to another in the red cell. Marchiafava and Bignami assert that they even escape from the red cell. Fragmentary degeneration of the estivo-autumnal parasite is said not to occur. In this type of infection the use of quinine at regular intervals of three or four hours is particularly important.

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[1] See collective investigation of this subject by the author in Therapeutic Gazette for July, 1892; also article in New York Medical Record, January 7, 1899.

It has been claimed, however, that quinine does not effect the spores or the organisms in the plasma but only the intracorpuscular parasites. Another view is that quinine does not act directly upon the parasite but produces in the body some substance, or substances, which in turn destroy it, and this view is supported by the fact that quinine disappears from the blood stream with great rapidity.

When malarial patients relapse the cause lies in improper use of the drug, or to the fact that some of the parasites are hidden in the bone-marrow or spleen, or to the fact that by frequent small doses the parasite has become immune to quinine. Ehrlich stated that in the latter cases an injection of neo-arsphenamine will at once cure the patient but other clinicians have found it inefficacious unless given with quinine. (For dosage in chronic cases see Intermittent Fever.)

For the reasons given in the preceding paragraphs quinine is the best remedy for malarial fever, and it should be given in doses which are indicated by the state of the patient. (See Administration and Intermittent Fever.) If possible it should always be preceded by a purge having an hepatic action. This preliminary treatment is particularly important in *bilious* or *remittent fever*. The drug should be given in one or two large doses in such a way that its influence is fully exercised, not only at the time of the expected paroxysm, but also an hour or thirty minutes before that time and every four hours thereafter. If the paroxysm is near at hand, the drug should be given in solution, bitter though it be, in acidulated water. If the attack be so far advanced as the sweating stage, it should be given, nevertheless, to destroy the spores just set free. The free use of the drug to arrest a given paroxysm or series of paroxysms is not sufficient. Quinine should be given freely not only until all paroxysms cease but even after the examination of the blood fails to show any evidence of infection.

(The student must read the article in Part IV, on Intermittent Fever at this point.)

LEGEND FOR FIG. 34.

FIG. 34.—ASEXUAL CYCLE OF PARASITE. 1, The proboscis of the mosquito injects sporozoites into the blood; 2, the sporozoite; 3, it enters a red corpuscle; 4, a red cell containing the developing parasite; 5, its further development; 6, the parasite undergoes segmentation and gives off spores; 7, some of these spores enter other red cells; 8, other spores enter cells to form female gametes (9); 10, still others enter cells to form male gametes (11); 12, proboscis of another mosquito sucks up both types.

SEXUAL CYCLE OF PARASITE. 1, proboscis of another mosquito draws infected blood which contains (2) the female gamete and (3) the male gamete; 3 and 4, the male gamete gives off flagellæ; 5, a flagellum fertilizes the female gamete; 6, represents the female after fertilization; 7, a zygote which enters the wall of the mosquito's stomach; 8, Oöcyte beginning to form; 9, ripe oöcystes loaded with sporozoites pushing into the body cavity; 10 and 11, sporozoites in the salivary glands; 12, the mosquito in biting for blood injects the sporozoites numbered 2 left hand side of diagram.

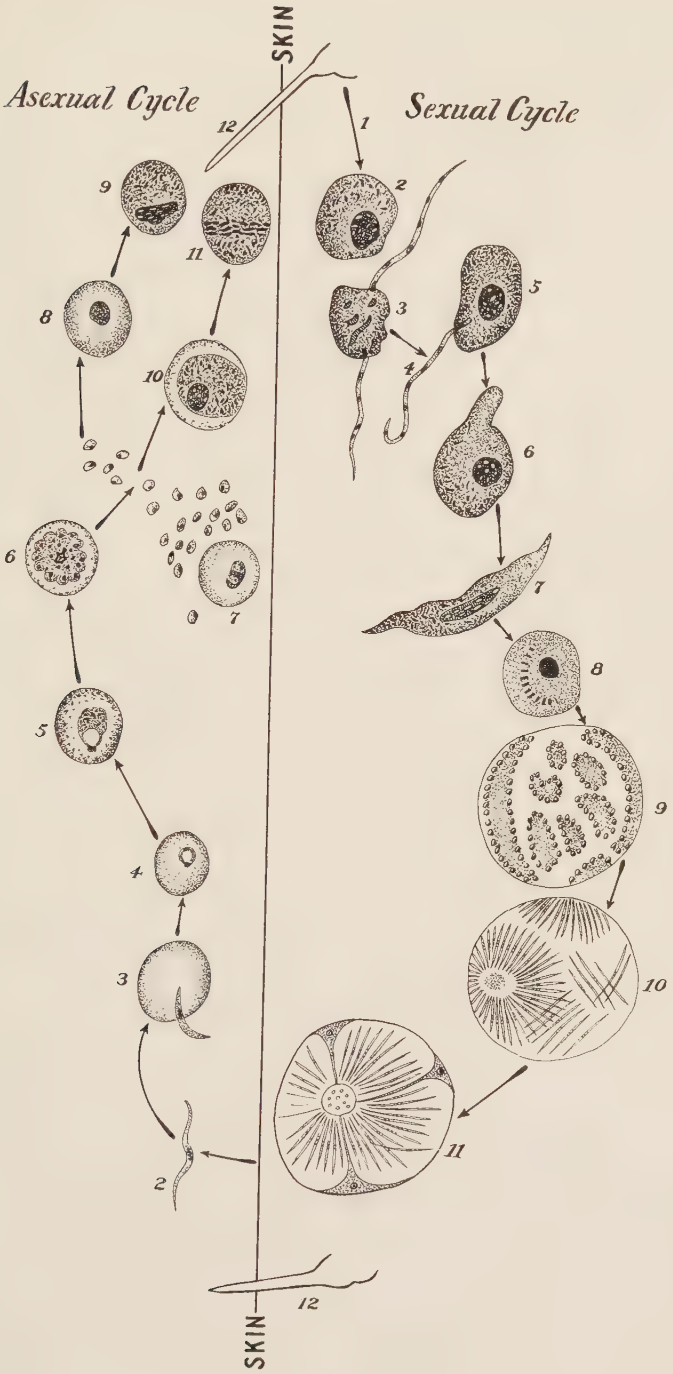
SKIN
Asexual Cycle
Sexual Cycle
SKIN

FIG. 34.

As a prophylactic against malaria the dose of quinine should be 2 to 4 grains (0.12–0.25) or more three times a day, but in this use of it there is danger of producing a strain of parasites immune to quinine and, therefore, difficult to eradicate. (See Intermittent Fever.) This is important to remember not only from the standpoint of the individual patient, but also because the sexual forms, which do not sporulate and produce paroxysms, are prone to persist so that a patient with no symptoms may be a "carrier," whereby infected mosquitoes spread the disease to other human beings. It is to be recalled that one man does not infect another except through the mosquito in whose body the development of the sexual cycle of the parasite takes place. (Fig. 34.)

In *hemorrhagic malarial fever* quinine sometimes seems to do more harm than good. Under such circumstances the danger in using quinine consists in irritating the engorged kidneys after the chill has passed. Quinine is not a hemostatic, and only does good in malarial hematuria by destroying the parasite which produces the bloody urine. In hematuria occurring in persons broken in health as a result of chronic malarial infection, quinine is of no value unless an examination of the blood reveals the presence of parasites. To give quinine after this symptom appears is to "lock the door after the horse is stolen" unless the parasites are found in the blood. Many studies in America, Greece, and Italy indicate that the use of quinine is capable of developing a hematuria.[1] (See Hematuria.) If, however an examination of the blood reveals the malarial parasite, the drug should be freely used. Malarial hemoglobinuria is probably not caused by quinine, but is probably due to an associated parasite. It has been suggested by Plehn that repeated attacks of fever sensitizes the patient's blood to the protein of destroyed parasites; therefore the quinine does not cause hemoglobinuria directly but indirectly by setting free such parasitic protein.

The use of caffeine and sodium benzoate in full dose is thought by some not only to increase diuresis but to exercise as antihemolytic effect.

In *pernicious malarial fever* quinine should be given by the mouth, as much as 60 to 70 grains (4.0–4.6) being used, or intramuscularly and intravenously. (See Administration and Intermittent Fever.)

For the reduction of the pyrexia of *typhus* or *typhoid fever* quinine is inferior to the newer antipyretics, even when given in very large dose, and it ought to be used rarely, if at all, for this purpose. In all fevers it will seldom cause a fall of temperature before *crisis* or *lysis*, but will aid in the fall after these changes have begun.

Quinine sulphate with acetyl-salicylic acid is often used in the treatment of *influenza*. If exposed to heat and moisture it decomposes and a poisonous product, quinotoxin results. These drugs should therefore not be kept mixed but prescribed freshly every few days.

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[1] See collective investigation of this subject by the author in Therapeutic Gazette for July, 1892; also article in New York Medical Record, January 7, 1899.

As a tonic quinine acts not only as a simple bitter, but also seems to have a direct effect in increasing the number of the red cells. The tonic dose should be 1 to 2 grains (0.06–0.12) three times a day.

Quinine has been used to overcome *uterine inertia* in weak women, but it is a feeble remedy, but is sometimes resorted to, particularly if combined with castor oil, to induce delayed labor. Some obstetricians believe that it increases the danger of postpartum hemorrhage. It will not of itself cause abortion, but in nervous, hysterical women who have a tendency to abort, and to whom it is necessary to give full doses of quinine during pregnancy, it may be well to combine some sedative, as one of the bromides or opium, with the antiperiodic.

In cases where prolonged *mental* or *physical* strain is to be undergone, quinine in the dose of 2 to 4 grains (0.12–0.25) will often prevent exhaustion and support the system.

The use of quinine may be resorted to in *whooping cough*, and the proper dose is 1½ grains (0.08) for each year of the child's age, to be given at 6 A.M., 2 P.M., and 10 P.M.

A much more agreeable method of pursuing this treatment in whooping cough is to give the patient the so-called quinine chocolates, which contain 1 grain (0.06) of tannate of quinine and chocolate in each. The taste of quinine in such chocolates is scarcely noticeable if they are well made, although the after-taste is bitter.

Used in solution in the form of a spray by the atomizer, quinine is of undoubted service in *whooping cough*, and will often prevent the spread of the disease to other children if they be subjected to its use. This solution should contain from 1 to 2 grains (0.06–0.12) to the ounce (30.0) and be employed every few hours. As Mallory and others have shown that the germ of whooping cough grows in the epithelial cells at the root of the tongue the quinine may exercise a direct germicidal effect. The bitter taste can be to some extent dissipated by the use of a cream peppermint drop before and after treatment. (See Euquinine.)

High rectal injections of quinine in the strength of 1 to 2000 are useful in *amœbic dysentery*, as this drug destroys the *Entamœba histolytica*. Rogers and other eminent Oriental practitioners advise that in *amœbic abscess of the liver* the pus be removed by aspiration and the cavity filled by the injection of a solution of 30 to 40 grains (2.0–2.6) of bihydrochloride of quinine. By this means the cavity, usually sterile except for the amœba, is kept sterile, and the patient avoids a serious operation when exhausted.

Quinine and urea hydrochloride has been proved to possess marked power in the production of *local anesthesia* in five to twenty minutes when injected in solution into subcutaneous or submucous tissues. It may also be applied in solution to mucous membranes for this purpose. The anesthesia may last from four to six hours or even several days when the drug is injected. For operative work it is employed in exactly the same manner as cocaine. It seems very efficient and is not as toxic as is cocaine. (See Coca.) The strength of the solution for infiltration anesthesia varies from 0.25 to 1 per cent, the weaker one usually giving the best results, as the stronger one sometimes causes the formation of an indurated area where injected and may cause a slough. For local application 10 to 20 per cent solutions are employed. Solutions ready for hypodermic use are now placed on the market in sterile ampoules. Injected into muscles involved, in the dose of 5 cc. of a 1 per cent solution, it relieves *lumbago.*

Quinine hydrochloride and urethane have come into very general use in the treatment of *varicose veins.* The formula used is 4 grains of the quinine hydrochloride and 2 grains of urethane in 2 cc. of distilled water. Great care must be taken that the needle enters the vein and not the perivenous spaces in which it will cause inflammation and possibly a slough. Pregnancy, phlebitis, advanced renal disease and myocardial degeneration contraindicate this plan of treatment. This compound appears in sterile ampoules ready for use. The solution is injected into the vein at the lowest point, usually in the quantity of about 1 cc., but subsequent injections may amount to 3 cc. delivered at intervals of 1 or 2 inches until a series of 5 are used according to the results achieved, that is until the vein is obliterated. After the needle is placed in the vein the thumb of the left hand compresses the vein on the distal side to prevent blood from entering it. Then a finger of the left hand compresses the vein above the needle. The injection is then made into the nearly empty vein with

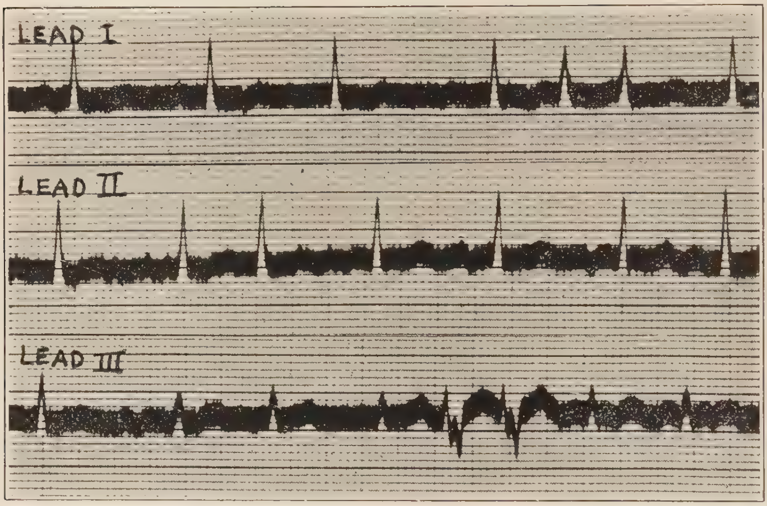

Fig. 35.—Auricular fibrillation. Ventricular rate 104. Recurrent five months after normal rhythm had been restored by quinidine sulphate. Note absence of P-wave, particularly in Lead I.

the pressure maintained for about two minutes so that the drugs may act locally. The injection acts by contracting the vessel and forming a clot which holds to its wall and is so firm that there is little danger of embolism. In 53,000 quinine injections only 7 deaths took place and they were not in cases in which this combination was employed.

Quinidine sulphate in the dose of 3 to 6 grains (0.2–0.4) every four hours day and night, has the power of overcoming *auricular fibrillation* in about 50 per cent of cases. It is unwise by its use to decrease the ventricular beats below 200. Lewis and others have shown that quinidine causes retardation of the auricles by a direct action on the Purkinje cells of the pace-maker, both in the sino-auricular node and the atrio-ventricular node. Unlike digitalis it does not slow the heart by a vagus effect, for it depresses or paralyzes these nerves as does atropine. Although this tends to increase the ease of passage of impulses over the atrio-ventricular area, such an effect is counterbalanced by a direct diminution of conducting power in the bundle of His. As we still are ignorant of all that quinidine can do in these cases it should not be used except where its effects can be watched by the aid of the electrocardiogram, and even if this aid is utilized the patient is not safe from ill-effects, because as yet we are unable to separate beforehand those cases which will be benefited and those that will be harmed. Large toxic doses given to animals paralyze the auricles, and it would appear that in very susceptible human beings the same results may occur. Cases have been reported in which its use in the presence of fibrillation of the auricles has been

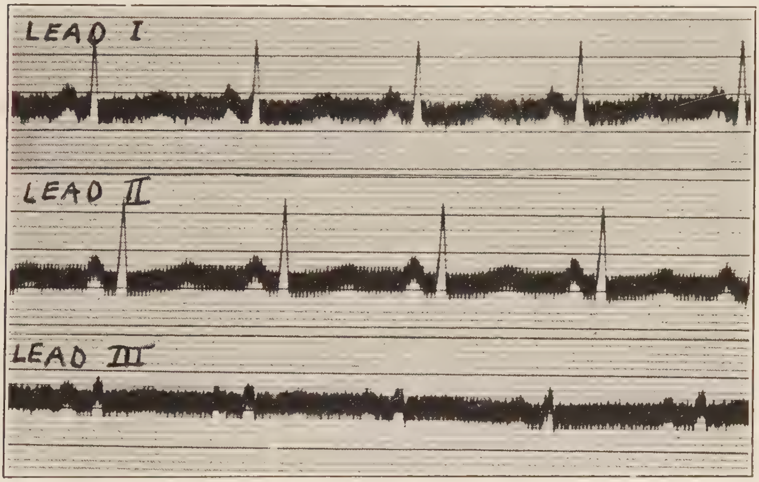

Fig. 36.—Regular sinus rhythm. Cardiac rate 66. Five days treatment with quinidine sulphate in ascending dosage. Largest dose 0.4 gram t. i. d. Note return of P-wave in all three leads.

followed by headache, faintness, vomiting and even convulsions; sudden death has ensued. So, too, the condition of the auricle predisposes to the formation of thrombi on its walls, and when normal function is restored such thrombi may be dislodged and cause embolism. Such a result may, however, follow the use of digitalis.

As Lewis has well said, the value of quinidine has so far been greater in adding to our knowledge of fibrillation of the auricles than it has been in therapeutics.

There is difference of opinion as to whether digitalis should be in effect when quinidine is given. Some have held that before quinidine is given the patient should be entirely free from the effects of digitalis. That is, it should not have been freely used for two weeks. In some cases, however, the use of both drugs simultaneously is definitely advantageous.

The best way to use quinidine is to give it in capsules. On the first day it is best to try out the patient with only 2 doses of 3 grains (0.2). If its effects are not bad because of idiosyncrasy, on the second day 3 doses of 6 grains (0.4) are given, on the third day 4 doses of 6 grains (0.4) and on the fourth day 5 doses of 6 grains (0.4). The dose is not to be increased beyond 30 grains (2.0) a day for a week, and as already stated, some physicians digitalize before its use, which is probably wise because if the heart is weak the digitalis strengthens it before the depressant effect of quinidine comes on.

Should the fibrillation return on the withdrawal of the drug it is best to continue it in small doses over a long period of time if the patient does not manifest any idiosyncrasy to it.

It is essential to avoid bad effects on the one hand or to get the best effects on the other that the patient be kept at rest in bed. If myocardial degeneration is marked or compensation is ruptured, quinidine is contraindicated as a rule because quinidine depresses the irritability, conductivity and contractility of the heart muscle. While on the one hand this effect tends to relieve fibrillation, on the other hand a heart already weak may suffer ill effects.

In *paroxysmal tachycardia*, either auricular or ventricular, a fairly full dose of quinidine taken at once will often arrest the rapid action present in a relatively short space of time and smaller doses taken regularly may prevent the attacks.

Wenckebach has highly commended doses of 5 to 15 grains of quinine in such cases if the onset of tachycardia is recent. He also claims that moderate doses of quinine with strychnine in cases of *cardiac arrhythmia*, particularly in instances of extrasystole are valuable, and that quinine combined with digitalis is a useful adjuvant.

Administration.—When prescribing quinine the physician should employ the hydrochloride (*Quininæ Hydrochloridum,* U. S. and B. P.), as it contains a high percentage of alkaloid (81.7 per cent quinine) and is very soluble in 1 to 18 of water. An acid hydrochloride (*Quininæ Dihydrochloridum,* U. S., *Quininæ Hydrochloridum Acidum,*

B. P.) (81.6 per cent quinine) is also official, possesses the advantage that it is soluble in less than its own weight of water. The hydrochloride of quinine is stronger in alkaloid than the bisulphate of quinine (*Quininæ Bisulphas,* U. S.), which is, however, soluble in the proportion of about 1 to 9 of water. The hydrobromide of quinine (*Quininæ Hydrobromidum,* U. S.) (76.6 per cent quinine) is another useful salt soluble in 1 to 40 of water. The sulphate of quinine (*Quininæ Sulphas,* U. S. and B. P.) (73.5 per cent quinine) the least soluble of all these salts, is by custom most commonly administered. *Quininæ Æthylcarbonas,* U. S. is very insoluble. (See Euquinine). *Quininæ Tannas,* U. S., is a salt not so bitter as the other salts, and is weaker in relative alkaloidal strength. One grain (0.06) of the tannate equals about $\frac{1}{4}$ grain (0.015) of pure alkaloid. The dose of the salts of quinine varies from 1 to 4 grains (0.06–0.025) as a tonic, and from 4 to 60 grains (0.25–4.0) for antimalarial purposes.

The B. P. recognizes a pill of quinine, *Pilula Quininæ Sulphatis,* a tincture (*Tinctura Quininæ*), a wine (*Vinum Quininæ*), and an ammoniated tincture (*Tinctura Quininæ Ammoniata*).

In regard to the administration of quinine, it may be said that it should never be given in solution if it can be avoided, because of its disagreeable taste, but if its prompt absorption is essential this is the best way to use it. If it is given in solution, the liquid should be well acidulated, as under these circumstances it will not taste so bitter as when a weakly acidulated solution is employed and it is more rapidly absorbed. In adults and children quinine should be used preferably in small capsules or in pills, which may be gelatin-coated or sugar-coated. Another means for adults is the use of cachets. If pills are employed, care should be taken that the sugar is not hardened by age, and if capsules are used that the gelatin is thin, for if the pill or capsule escapes into the intestine before it is dissolved the quinine is precipitated and is not absorbed. If the case is that of a child too young to take a pill, the drug may be given in the following manner without tasting very disagreeably:

℞—Quininæ hydrochloridi . . . . gr. xvj (1.0)
Fluidextracti glycyrrhizæ . . . . f ʒj (4.0)
Syrupi aurantii . . . . f ℥ij (60.0).—M.
S.—A teaspoonful t. i. d. for a child of three years.

Tannate of quinine chocolates may be used, but even if they are well made the after-taste of quinine is marked. The rectal use of quinine is hardly justifiable. Little is absorbed and rectal irritation is prone to occur.

Quinine should be given by the hypodermic needle only when the infection is so severe as to endanger life or when the stomach is too irritable to retain the drug, and if the need is so urgent the intravenous method is preferable. (See page 237.) If given hypodermically, the injection should be intramuscular, because it is less prone to cause abscess and severe pain, and also because it will be more rapidly absorbed from the muscular tissues than from the subcutaneous tissues. One of the great muscles of the back is to be chosen. When given by the needle the best salt is the dihydrochloride, often called the acid hydrochloride, which is very soluble (about 1 part to 1 of water). The ordinary dose when given in this manner is 10 grains (0.65). The greatest possible precautions as to the maintenance of rigid asepsis of the skin, the needle, the syringe, the solution, and even of the salt itself is essential to avoid abscess. Intramuscular injections are contraindicated in the presence of general debility as it is in these patients that severe sloughs are more prone to occur. A second injection should never be near the first. Further, the solution must not be concentrated, but dilute (1 to 10 at least), because in concentrated solution quinine damages the tissues and destroys the phagocytes which ordinarily hurry to a damaged area to destroy any pathogenic organisms which may gain access to the devitalized spot. After the injection the part should be massaged and a hot-water bottle applied to hurry absorption.

In India a considerable number of cases of tetanus have followed the intramuscular use of quinine.

A useful way of using the drug is to employ a solution in sterile water put up in glass ampoules, ready for use, containing about 4 grains (0.25) each, or

℞—Quininæ hydrochloridi	gr. iijss (0.15)
Urethani	gr. ij (0.12)
Aquæ destillatæ	f ʒj (4.0).—M.

This solution is said to keep indefinitely.

When the dihydrochloride is not at hand, the hydrochloride of quinine may be used, as it is soluble in about 18 parts of water, and contains more of the alkaloid than the more soluble bisulphate of quinine. It may be employed in the following manner:

℞—Quininæ hydrochloridi	gr. vij (0.5)
Glycerini,	
Aquæ destillatæ	āā f ʒss (2.0).—M.

S.—Warm solution before using it, and do not add acid.

℞—Quininæ hydrochloridi	gr. xv (1.0)
Alcoholis	♏xv (1.0)
Aquæ destillatæ	f ʒiss (6.0).—M.

S.—Add a drop of dilute hydrochloric acid to complete solution before using.

If the bisulphate is used intramuscularly, to its solution should be added a little tartaric or sulphuric acid to prevent precipitation of the drug in the alkaline juices of the connective tissue before it can be absorbed. The tartaric acid should be present in the proportion of about 1 grain (0.06) to each 5 grains (0.3) of the quinine. The hydrobromide of quinine, the solubility of which is about 1 to 40 of water, may also be used intramuscularly, as may also the bimuriate of quinine and urea (*Quininæ et Ureæ Hydrochloridum*, U. S.), which, however, is scarcely more than half as strong in quinine as the other salts. All of these injections are painful except the last and all may cause sloughing, particularly if pathogenic bacteria are in the body.

As all salts of quinine when injected intravenously are prone to cause hemolysis, because of their acid radicle, Brahmacheri has devised the following formula:

℞—Quininæ	gr. v (0.3)
Alcoholis	♏ j (3.2)
Urethanæ	gr. iij (0.22)
Calcii chloridi	gr. vij (0.5)
Glucosi	gr. iij (20.0)
Liquoris sodii chloridi physiologici	f℥ x (320.0)

M. S.—Inject very slowly into a vein.

It is perceived that this formula necessitates a massive injection. On the other hand McLean, Michael and others have strongly advocated the intravenous injection of strong quinine solutions in malaria and even in cases of malarial hematuria in which the parasite is found in the blood. The excellent effects they claim to be produced may be explained by the fact that under these circumstances the quinine has been shown to pass, within a few minutes, from the blood plasma to the corpuscles, so that the corpuscles take up most of it. This, of course, permits the drug to directly attack the parasite in its period of development. The dihydrochloride may be dissolved in sterile water so that each cc. contains 1 grain. Of this solution 10 or 15 cc. (10 or 15 grains of the drug) are injected in each dose. The solution should be freshly prepared, well sterilized, and the fluid injected *very slowly*. A sense of flushing of the surface of the body ensues sometimes accompanied by dizziness. Some headache may develop. The patient should lie down for a few minutes. Doses may be given once or twice a day. Less reaction, due to the small amount of water used, is met with than when bulky solutions are employed.

Sulphate of cinchonidine (*Cinchonidinæ Sulphas*, U. S.) is very useful in *influenza* combined with salicin or one of the newer salicylates.

The dose of quinidine sulphate (*Quinidinæ Sulphas*, U. S.) is about that of quinine, as is also that of cinchonine sulphate (*Cinchoninæ Sulphas*, N. F.) and cinchonidine sulphate (*Cinchonidinæ Sulphas*, U. S.).

Chinoidinum is a resinous mass obtained in the preparation of the alkaloids of cinchona, and contains amorphous alkaloids. It possesses distinct antiperiodic power, and was used freely when quinine was a very expensive drug. Its dose is three or four times that of quinine.

The liquid preparations of cinchona are the infusion (*Infusum Cinchonæ*), dose a wineglassful (30.0); the tincture (*Tinctura Cinchonæ,* U. S. and B. P.), 1 or 2 teaspoonfuls (4.0–8.0); and the compound tincture (Huxham's) (*Tinctura Cinchonæ Composita,* U. S.

and B. P.), a teaspoonful to a tablespoonful (4.0–16.0). Tincture of cinchona should contain from 0.8 gram to 1.0 gram of cinchona alkaloids in each 100 cc. Huxham's tincture is a most efficient and elegant bitter tonic in debility and convalescence from low fevers. It is too weak in alkaloids to be used in malarial infection. Under the name of Elixir Roborans, or Whytt's tincture, a similar mixture is employed for the same purposes. The other liquid preparation is the fluidextract (*Fluidextractum Cinchonæ*, U. S., or *Extractum Cinchonæ Liquidum*, B. P.), which contains from 4 gram to 5 gram of the cinchona alkaloids in each 100 cc., dose 5 to 15 minims (0.3–1.0). A solid extract (*Extractum Cinchonæ*) is given in the dose of 5 to 10 grains (0.3–0.6). The B. P. preparation not official in the U. S. P. is the *Infusum Cinchonæ Acidum*, dose ½ to 1 fluidounce (15.0–30.0).

Contraindications.—Quinine is contraindicated in gastritis, cystitis, meningitis, epilepsy, and middle-ear disease, because it congests, irritates, or stimulates those areas which are diseased, and is also contraindicated in those cases which have an idiosyncrasy to its action.

CINCHOPHEN.

This substance is official under the name *Cinchophenum* (U. S.). It is sometimes called atophan. It is an almost colorless, tasteless, crystalline powder, insoluble in water, but readily soluble in alkalies or hot alcohol. A number of investigators have proved that it greatly increases the elimination of uric acid and it undoubtedly relieves pain in gouty and lithemic persons, but that it is directly useful in the cure of *gout* is undecided, for gout is something more than the mere formation and retention of uric acid in excess. The increase in the elimination of uric acid is, moreover, due chiefly to the action of the drug on the kidneys. It does not mobilize deposited urates. It has been claimed to be equal to the salicylates in *acute rheumatic fever*. This has not proved to be true in my experience. It has also been proved that the large doses sometimes essential to get desired effects may cause urticaria and irritation of the kidneys. The urine should be constantly examined if full doses are used, and the drug stopped if albuminuria develops, or if nausea or loss of appetite come on. Furthermore, if the kidneys are not normal, the drug should not be given at all. (See Neocinchophen which is less apt to upset the stomach.)

A number of cases of toxic hepatitis with jaundice have been reported after full doses of this drug. Symptoms of acute yellow atrophy of the liver have suddenly developed after its continued use. It is to be used with caution if there is reason to believe that hepatic disease is present and the liver should be kept well stored with glycogen, particularly if nutrition has been impaired. In many cases the best results and the least danger will be induced by giving cinchophen for three days and then resting three days.

Cinchophen is best given in tablets or capsules, or powder stirred in water after meals and at bedtime, being washed down with a full draught of water, preferably Celestin Vichy water, or water containing sodium bicarbonate. The ordinary single dose is 7 to 10 grains (0.5–0.65) three or four times a day.

CINNAMON.

Cinnamon (*Cinnamomum*, U. S.; *Cinnamoni cortex*, B. P.) is the inner bark of a plant, a native of Ceylon or of the species indigenous to China. It contains a volatile oil and tannic acid. In overdose the oil acts as a soporific and kills by failure of respiration.

Therapeutics.—Cinnamon is used, as are all the drugs of its class, for flavoring, as a *carminative*, and as an intestinal stimulant in *serous diarrheas*. It has the peculiar power of acting as a hemostatic in *uterine hemorrhage* where the flow is oozing and not active, thereby differing from the other volatile oils, with the exception of that of erigeron. The oil of cinnamon is a powerful antiseptic, which can be used in dilute form in the dressing of wounds and by injection in *gonorrhea*.

Cinnamic acid, a derivative of oil of cinnamon, is also used for the same purposes; but its chief employment has been in the treatment of *tuberculosis*. This consists in injecting hypodermically and intramuscularly 2 minims (0.1) of the acid. The injection produces burning pain, which soon disappears. The patient, however, feels fatigued, has vertigo and cerebral congestion. Gradually the dose is increased to 15 minims (1.0), and after several weeks the patient is said to cough less, to gain in weight, and to improve in physical signs. The treatment is so painful that it has not gained favor.

Administration.—The dose of the oil (*Oleum Cinnamomi*, U. S. and B. P.) is 1 to 5 minims (0.05–0.3); of the water (*Aqua Cinnamomi*, U. S. and B. P.) a wineglassful (30.0) or less; of the spirit (*Spiritus Cinnamomi*, U. S. and B. P.), 5 to 30 minims (0.3–2.0); of the tincture (*Tinctura Cinnamomi*, B. P.), ½ to 1 dram (2.0–4.0). Under the name of *Pulvis Aromaticus*, N. F. (*Pulvis Cinnamomi Compositus*, B. P.), a carminative powder, consisting of cinnamon 35 grams, nutmeg 15 grams, cardamoms 15 grams and ginger 35 grams, is official. The B. P. preparation does not contain nutmeg. Aromatic powder is useful in the treatment of the *flatulence* of adults and children. The latter should take about 10 grains (0.6) at a dose, an adult 30 grains (2.0).

Pulvis Aromaticus also enters into the composition of *Fluidextractum Aromaticum*, which is given in the dose of 10 to 60 minims (0.6–4.0).

CITRIC ACID.

Citric acid (*Acidum Citricum*, U. S. and B. P.) is chemically identical with the acid of the lemon, but has not identical influences upon the body with lemon-juice.

Not only does the lemon owe its acidity to this acid, but most of the other edible fruits, such as oranges and grapefruit, depend upon its presence for their acidity.

Therapeutics.—Citric acid in the form of lemon- or lime-juice is used in *scurvy*, or *scorbutus*, as a prophylactic and cure because they contain vitamines. In order to keep lemon-juice from decomposition on long voyages, it should be pasteurized and poured while warm into bottles until it nearly reaches the cork; the remaining space is then filled with a thin layer of hot sweet oil and the bottle corked and stood upright. Under these circumstances the juice may be kept indefinitely. If the juice is boiled the vitamine content may be destroyed.

In *rheumatism*, either *acute* or *chronic*, lemon-juice may be employed in the dose of 1 to 2 ounces (30.0–60.0) four times a day, well diluted, or 2 drams (8.0) of citric acid may be given.

The preparations containing citric acid are *Syrupus Acidi Citrici*, U. S.; *Succus Limonis*, B. P., and *Syrupus Limonis*, B. P.

CLOVE.

Clove (*Caryophyllus*, U. S.; *Caryophyllum*, B. P.) possess an aromatic odor and the pungent taste of a typical spice. It contains a volatile oil (*Oleum Caryophylli*, U. S. and B. P.).

Therapeutics.—Clove, or its oil, is used in medicine for its *carminative* effect. It is also employed as a stimulant and tonic to the stomach, to prevent griping during an attack of *diarrhea*, or that caused by purgatives, to act as a flavoring agent, as a counterirritant, as a *parasiticide*, and as a local *anesthetic*.

The oil of clove possesses great power for good in many cases of *pulmonary tuberculosis* and *bronchiectasis* when cough and expectoration are excessive, as it greatly diminishes the quantity of sputum expectorated. It should be given in the dose of 5 minims (0.3) in capsule one hour after food three or four times a day, or a hypodermic injection of sterilized almond oil, containing in each dose of 30 minims (2.0) 5 minims (0.3) of the oil of clove, should be administered once a day preceded by a small injection of a 2 per cent solution of procaine. The injection should be given into the subcutaneous tissues of the flank or abdomen, and is painful if procaine is not used, but the decrease in the cough and expectoration amply repays the patient for the pain.

Like all volatile oils, this oil is an efficient local application for *pediculosis pubis* and similar parasitic affections. It may be used in *toothache* because of its anesthetic powers, placed on a pledget of cotton in the cavity of the aching tooth. In the treatment of *myalgia* or *muscular rheumatism*, oil of clove is often placed in a liniment for its counterirritant effect. Doses of ½ to 1 minim (0.03–0.06) of the oil in a little water will sometimes control *excessive vomiting*. In addition to the oil the B. P. has an official infusion, *Infusum Caryophylli*, the dose of which is ½ to 1 fluidounce (15.0–30.0).

In overdose oil of clove acts as a soporific, and kills by failure of respiration and the production of severe gastro-enteritis.

COCA AND COCAINE.

Coca is the dried leaves of *Erythroxylon coca*. Cocaine (*Cocaina*, U. S. and B. P.); *Cocainæ Hydrochloridum*, U. S. and B. P.) is the alkaloid derived from *Erythroxylon*. When cocaine is heated with hydrochloric acid it is split into several substances, among others a base called ecgonine, which has wholly different properties from cocaine, and is perhaps responsible for some of the evil effects which have resulted from improperly prepared cocaine. It is to be distinctly understood that *Erythroxylon coca* is not the same as chocolate or *Theobroma cacao*.

Physiological Action. — Coca and its alkaloid cocaine, when taken internally, produce in some persons a sense of exhilaration and pleasure. Often muscular and mental activity is temporarily increased under their influence. When locally applied to a mucous membrane, cocaine causes blanching followed later by marked congestion.

Nervous System.—The dominant action of cocaine, when locally applied to the peripheral sensory nerves, is to paralyze them (Fig. 37). When taken internally it stimulates the brain to an extraordinary degree, but exercises no effect upon the sensory nerves unless given in poisonous doses. Sometimes its internal use produces a decrease of sensation, which Mosso believes to be due to an influence on the spinal cord. This effect is, however, very feeble. If the dose be a poisonous one, convulsions of cerebral origin ensue, and are both clonic and tetanic in type.

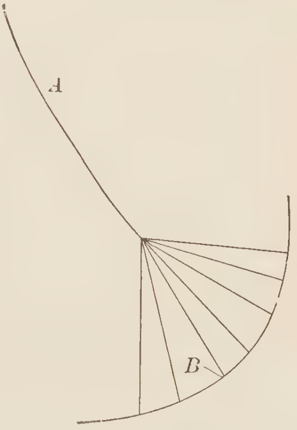

Fig. 37.—*A*, sensory nerve supplying mucous membrane (*B*), which is anesthetized by cocaine, paralyzing the ends of the sensory nerve at *B* when locally applied.

Upon the muscles, when taken internally, Mosso has proved the drug to be a direct stimulant, and it is particularly active after starvation or fatigue. Muscular power is increased temporarily by cocaine by setting free reserve energy.

Circulation.—Cocaine in moderate amounts acts as a mild stimulant to the heart and vasomotor center, but in full doses it is a cardiac depressant.

Respiration.—The drug acts as a powerful respiratory excitant, producing in large dose a great increase in the rapidity of the respiratory movements, but in poisonous dose it kills by failure of respiration associated with exhaustion from the accompanying convulsions.

Temperature.—Cocaine raises bodily temperature to an extraordinary degree if given in overdose, this rise being due to an increase of heat production (Reichert). In moderate or medicinal amounts it has no such effect.

Kidneys, Elimination, and Tissue-waste.—The drug is eliminated by the kidneys, but is chiefly destroyed by oxidation in the body. Under its influence the quantity of urine passed is increased and the nitrogenous elements eliminated in this fluid are slightly diminished.

Eye.—Owing to its powerful action as a local anesthetic, cocaine has been used largely in diseases of the eye, and it is particularly efficacious in this organ because of the delicacy of the conjunctiva, which it readily penetrates and so paralyzes the peripheral sensory nerve endings. The anesthesia comes on in from one to five minutes after the use of the drug, according to the strength of the solution used. When cocaine is applied to the eye, it causes a very marked stinging sensation, distinct enlargement of the palpebral fissure and an apparent prominence of the eyeball. This is due to a stimulant effect of the cocaine upon the sympathetic nerve fibers which supply the unstriped muscle fibers of the lids. Accompanying this effect, there is marked dilatation of the pupil, which Köller asserts is due to constriction of the bloodvessels of the iris, the muscular fibers being unaffected. Ophthalmologists, however, generally assert that this mydriasis is due to the fact that the drug stimulates the peripheral ends of the sympathetic nerves. It is important to remember that this dilatation, unlike that produced by mydriatics, such as atropine, is not accompanied by paralysis of accommodation, and the dilatation of the pupil can be overcome at once by the use of eserine or pilocarpine. The drug does not cause a forcible mydriasis, and is never used for the prevention of adhesions in iritis unless combined with atropine.

Therapeutics.—Cocaine hydrochloride (*Cocainæ Hydrochloridum*, U. S. and B. P.) is used as an anesthetic in the eye in the strength of from 3 to 5 or more minims of a 1 to 4 per cent solution. The strength of 2 and 3 per cent is perhaps most commonly employed. It is worth remembering that cocaine is soluble in fats, whereas its salts are not. Cocaine itself should therefore be used in anesthetic salves, and may be used for this purpose in an oleate (*Oleatum Cocainæ*) which contains 5 per cent of cocaine. The local anesthetic effect of cocaine is materially increased by using adrenalin solution (1 to 5000 to 1 to 1000) with it. This combination also decreases the danger of systemic effects being produced by cocaine, since the constriction of the bloodvessels by the adrenalin prevents the absorption of the cocaine. This prevention of the dissipation of the cocaine through absorption also increases the local anesthetic effects of the latter drug.

The conditions indicating its use in the eye are all operations of a painful character, and it may also be used for the relief of pain, when an *acute inflammation* or *foreign body* is causing suffering. The following formula will be found useful in these states:

℞—Cocainæ hydrochloridi	gr. viij (0.5)
Acidi borici	gr. vij (0.46)
Aquæ destillatæ	f℥j (30.0).—M.

S.—Use with a dropper in the eye every fifteen minutes until relieved.

Cases of keratitis are recorded in which cocaine has produced permanent corneal opacities, and it may cause dryness and roughening of the corneal epithelium even in the normal eye.

Owing to the density of the mucous membranes of the vagina and rectum, cocaine has little effect upon them unless used in 10 per cent solution and freely applied. In the mouth cocaine may be used in cases of *stomatitis* where a spot is to be cauterized and in *pharyngitis*. While it gives much temporary relief in *pharyngitis*, the subsequent effects are often exceedingly disagreeable, the congested area looking more angry and being more painful than before. In *coryza* and *hay fever* a powder consisting of cocaine, morphine, and bismuth in the proportion of 1 part each of the two alkaloids and 5 parts of the bismuth will often be of service if snuffed into the nostrils.

Cocaine may be used in the place of ether in cases requiring *amputation of the fingers* or in cases of minor surgery where the action of the drug can be confined to the part injured. A rubber band should be tightly put around the base of the finger and a 4 to 8 per cent solution injected into the part, the band about the base of the digit being used to prevent hemorrhage and systemic absorption of the drug. After the operation is completed slight hemorrhage should be allowed to occur, to sweep out the drug and thereby avoid a systemic effect. Not more than $\frac{1}{4}$ grain of cocaine should be injected. When operations on a foot or hand have been done under cocaine anesthesia, and larger amounts than this have been used, the constricting bandage should be allowed to remain in place some time, since the tissues destroy the drug, so that when the bandage is removed less is aborbed. (Hölscher and others.) (See Procaine.)

When a limb is to be amputated under cocaine, the main supplying nerve should be exposed by the aid of infiltration anesthesia (see below), and then the nerve trunk is to be anesthetized by the injection into its sheath of so weak a solution of cocaine in normal saline fluid as 1 per cent.

Under the name of "*infiltration anesthesia*" Schleich has introduced a method of abolishing sensation in localized areas which often gives good results for minor operations. He injects *into* the skin, as superficially as possible, a sufficient amount of a solution of common salt, cocaine, and morphine to produce local edema, and thereby pressure on the nerve filaments, which are also depressed by the cold liquid coming in contact with them. He also believes that the local anemia so caused aids in decreasing sensation. The injection is given so gently that a sort of wheal or edematous spot is produced where the incision is to be made. As soon as this spot is developed the needle is inserted into its margin and carried under the skin a little farther, and then the injection is repeated. In this way the line of an extensive incision can be anesthetized progressively. If deep incisions are necessary, the injections are made into the deeper tissues as well. The injections must always be made into healthy skin, as if it is diseased a slough may result. Schleich asserts that similar injections under the periosteum permit of operations on the bones. The anesthesia lasts twenty-six minutes. The solution is of three strengths as follows:

Solution.	I.	II.	III.
Cocaine hydrochloride	gr. iv (0.25)	gr. ij (0.12)	gr. $\frac{1}{5}$ (0.012)
Morphine hydrochloride	gr. $\frac{1}{2}$ (0.03)	gr. $\frac{1}{2}$ (0.03)	gr. $\frac{1}{10}$ (0.006)
Sodium chloride	gr. iv (0.25)	gr. iv (0.25)	gr. iv (0.25)
Sterilized distilled water	f℥iv (120.0)	f℥iv (120.0)	f℥iv (120.0)

To each of these solutions 3 minims of a 5 per cent solution of phenol are added. The second solution is the one commonly used. The first is employed where acute inflammation is present, and the third where repeated injections are necessary. (See Fig. 38.) The effect of these injections is considerably emphasized if adrenalin chloride in the proportion of 1 to 20,000 is added to the mixture.

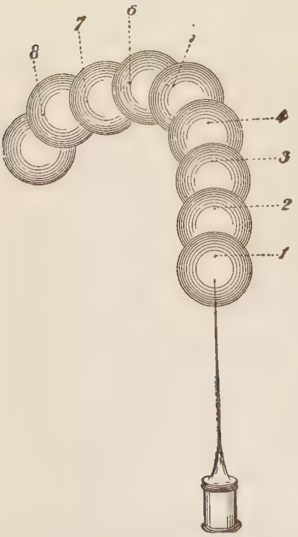

FIG. 38.—Infiltration anesthesia. The needle is inserted at each successive point as numbered until the line of anesthesia is complete.

For minor localized operations it is very satisfactory; but for long and deep incisions it is of little value, as its effects are inadequate unless doses so large as to be poisonous are employed, and because it in no way diminishes the fear and mental suffering of the patient, in whom the dread of the operation is worse than the actual pain. Under certain circumstances, however, it may be used in major surgery, such as tracheotomy, the removal of small superficial tumors, and in those patients who are so profoundly ill that it is dangerous to use a general anesthetic, as, for example, in intestinal perforation in typhoid fever, an operation which has been done many times with this method. As the operation proceeds the deeper tissues are anesthetized by infiltration if possible, and are cut, not torn, as the tearing produces great pain. Great care is necessary that the fluid injected is sterile. (See Procaine.)

In place of Schleich's fluid the following plan is now commonly followed: A tablet containing $\frac{3}{4}$ grain (0.045) of cocaine hydrochloride with $\frac{1}{400}$ grain (0.00015) of adrenalin chloride is dissolved in 50 cc. of normal salt solution. Another similar tablet is dissolved in 100 cc. of normal saline. The stronger solution is used to infiltrate the skin and the weaker to infiltrate the looser and deeper tissues as the operation proceeds. Fill a 2 cc. Record syringe armed with a fine needle for the injection of the stronger fluid and a 5 cc. Record syringe with a large and coarser needle for the weaker fluid. Precede the infiltration anesthesia by half an hour with from 0.1 to $\frac{1}{4}$ grain (0.006–0.016) of morphine and $\frac{1}{200}$ (0.0003) of scopolamine given hypodermically, and if the patient is restless or suffers pain during the operation repeat this dose. The operator must not hurry but give the injected fluids time to act as he proceeds from tissue to tissue. (See Scopolamine-morphine Anesthesia.) Procaine, because of its low toxicity, has largely supplanted cocaine for these purposes. (See Procaine.) For the methods employed for the induction of anesthesia by injecting special areas, the reader is referred to special books on that subject, as, for example, Farr's *Local Anesthesia,* also Braun's *Local Anesthesia.*

Cocaine and eucaine (see also Alypin, Stovaine, and Tropacocaine) have been used to produce anesthesia of large areas of the lower portions of the body and limbs by injecting them into the subarachnoidean cavity below the termination of the spinal cord by means of a long hollow needle, so-called spinal anesthesia, but, as the toxicity of these drugs is greater than some of the other local anesthetics, they have been supplanted by the newer drugs of this class. (See Stovaine and Procaine.)

Internally, cocaine or the fluidextract of coca may be used as a temporary supportant and stimulant in *low fevers,* and in cases where great physical and mental strain must be borne. Its use for any length of time is dangerous and harmful. In the *vomiting of pregnancy* and other forms of *excessive emesis* it is of some service by depressing the gastric sensory nerves and thereby decreasing the irritability of the stomach.

Cocaine is stated to be an antidote to acute morphine poisoning.

Cocaine is undoubtedly of service in the *opium habit,* but if continuously used soon changes the patient from a morphinomaniac to a "coca fiend," and for this reason should not be employed.

The dose of the fluidextract (*Extractum Cocæ Liquidum,* B. P.) is from $\frac{1}{2}$ to 1 dram (2.0–4.0), and it should contain 0.5 Gm. of ether-soluble alkaloids in each 100 cc. The dose of cocaine is from $\frac{1}{4}$ to $\frac{1}{2}$ grain (0.015–0.03). The other B. P. preparations are *Lamellæ Cocainæ,* each disk containing $\frac{1}{50}$ grain (0.0012) of cocaine hydrochloride, and *Unguentum Cocainæ* and *Injectio Cocainæ Hypodermica,* given in the dose of 1 to 10 minims (0.06–0.6).

The *cocaine habit* is a condition unfortunately frequently met with since the introduction of this drug into therapeutics. It is often combined with the morphine habit, and sometimes cocaine is employed as a substitute for morphine. The symptoms of the cocaine habit consist of marked loss of flesh, disorders of the circulatory system, mental failure, and delusions sometimes resembling those of chronic alcoholism. Often disagreeable hallucinations are present. The habit is difficult to cure, for relapses are frequent and mental and physical degeneration takes place far more rapidly than when morphine is abused. (See Opium.) The body rapidly becomes accustomed to cocaine so that doses many times in excess of an ordinary fatal dose may be taken with impunity by the patient. The sudden withdrawal of cocaine from a patient may result in profound collapse.

According to Magnan, a pathognomonic symptom of chronic or subacute cocaine intoxication is a sensation under the skin of a crawling worm or bug.

Untoward Effects.—Loss of speech, blindness, nausea and vomiting, syncope, and unconsciousness have followed the internal use or local application of cocaine. Epileptiform convulsions have also been noted, while the circulation and respiration have been disordered in every possible manner. In many of these cases the urine passed after the poisoning has been copious, limpid, and contained albumin. Curiously enough, a large number of cases of severe poisoning have followed the injection of cocaine into the urethra previous to operation for the relief of chronic gonorrhea or stricture.

These symptoms may ensue in susceptible persons after the use of quantities received with impunity by others. Thus, they have followed the instillation of 20 minims of a 10 per cent solution, but recovery has ensued after the ingestion of 15 grains (1.0) by the mouth.

The hypodermic injection of cocaine sometimes causes vomiting.

Of 250 cases of accidental poisoning arising from the medicinal use of the drug but 13 proved fatal.

The treatment of the poisoning consists in the use of ammonia, coffee, strychnine, or ether if the symptoms are those of depression. If they are convulsive in type, then the treatment to be instituted is the intramuscular or hypodermic injection of barbital sodium 3 to 5 grains (0.22–0.30) in normal salt solution 20 to 30 minims (1.3–2.0), or is identical with that of strychnine poisoning (which see).

CODEINE.

Codeina, U. S. and B. P., soluble in water 1 to 120, is an alkaloid derived from opium. It is often contaminated by morphine. The sulphate of codeine (*Codeinæ Sulphas*, U. S.) is generally used, as it is more soluble than codeine itself. Codeine phosphate (*Codeinæ Phosphas*, U. S. and B. P.) is also official.

Physiological Action.—Codeine resembles morphine very decidedly in its physiological action, the chief difference being that it possesses less narcotizing power, but in large amount it more readily produces tetanus and final paralysis of the peripheral motor nerves in the lower animals (Dott and Stockman). Because of its relative weakness in relieving pain it ought not be used for this purpose. It does not arrest secretion in the respiratory and intestinal tract, as does morphine, and therefore does not directly check expectoration and is less apt to cause constipation.

Therapeutics.—Codeine has been highly recommended for years as a nerve quietant in *nervous cough* and in cases where the cough is *excessive* in *bronchitis* and *phthisis*. In *diabetes mellitus* some clinicians have found it of value, while others have been disappointed in its use. It should, however, always be tried in this disease if there is insomnia and great nervous irritability, in the hope that it may exercise a favorable effect. When given for obstinate cough it should be used in the dose of from $\frac{1}{10}$ to $\frac{1}{4}$ grain (0.006–0.02) three or four times a day, in the syrup of wild-cherry bark. When given for diabetes the dose should be much larger, beginning at 1 or 2 grains (0.06–0.12), and rapidly increasing it until the glycosuria is diminished. Sometimes as much as 20 or 30 grains (1.3–2.0) or more may be given daily. Many physicians do not believe that codeine is a habit-forming drug. The B. P. recognizes a syrup (*Syrupus Codeinæ Phosphatis*) given in the dose of 1 to 2 drams (4.0–8.0).

COD-LIVER OIL.

Oleum Morrhuæ, U. S. and B. P., sometimes called *Oleum Jecoris Aselli*, is a fixed oil obtained from the fresh livers of *Gadus morrhua*, or cod-fish. There are several species of cod from which the oil is obtained other than the one named, but that given is the chief source of supply. The oil is pale or dark according to its freedom from foreign materials. Although the paler oils are generally prescribed, there can be little doubt that the darker ones are more medicinally active. The most prominent inorganic constituents of the oil are iodine, bromine, and sulphuric and phosphoric acids. It also contains more or less of the biliary salts. The U. S. P. provides a physiological assay of the oil which must show 50 units of vitamine A per cc. A unit is the minimum daily amount of cod-liver oil required to cure induced symptoms of vitamine A starvation in young albino rats and to cause a gain in weight of from 10 to 20 grams within a period of thirty-five days. As a matter of fact a cod-liver oil containing approximately 13,000 units of vitamine A and 2000 of vitamine D in each fluid ounce is obtainable (see Vitamines) on the market and such an oil is always to be used.

Lofoten cod-liver oil, obtained from cod caught near the Lofoten Islands, is generally considered the best for medicinal use.

Physiological Action.—Cod-liver oil depends on a number of substances for its peculiar effect. The iodine certainly exerts definite alterative powers, and the oil seems peculiarly adapted to digestion and absorption, for cod-liver oil passes through animal membranes very readily, probably owing to the biliary salts contained in it.

Investigations of the last few years have shown that a large part of its value is due to its high content of fat-soluble vitamines A and D which are in part destroyed or diminished if the oil is too greatly purified in order to make it more agreeable.

The oil aids in the maintenance of bodily temperature by its oxidation, and indirectly causes a deposit of fat in the tissues. It also seems to influence the blood directly, for clinical observation shows that anemic persons become healthy-looking under its use, and Cutler and Bradford have found that this apparent improvement is a physiological fact, the red corpuscles being always increased. It has been proved by experiment that cod-liver oil is more readily oxidized than any other oil, and recent investigations by several clinicians show that cod-liver oil exercises a regulating effect upon calcium and phosphorus metabolism, enabling the patient to utilize these substances more efficiently and even to aid the body in conserving these substances in the body if they are not supplied in normal quantity in the food. As already stated its value in rickets depends upon the vitamines A and D of which the latter is the more effective.

Therapeutics.—Cod-liver oil is useful in those persons who have no tubercular lesion in the lung or other tissues, but have mucous membranes which are very susceptible to disease. This state has been called the *pretubercular stage of phthisis.* Cod-liver oil possesses no curative power in cases of well-developed and rapid phthisis, and its administration in many cases serves only to nauseate the patient or to produce an oily diarrhea through failure of digestion. It does good in the early stage of the disease in that it acts as a food peculiarly suited to a wasting malady, and its mild alterative effects are also of value. It maintains the patient's strength and general nutrition, and so favorably influences the pulmonary lesion, provided it can be taken in addition to good food. If it destroys the appetite or disorders the digestion it is very harmful. In *chronic rheumatism* the drug is often of great service, particularly if the disease is largely muscular. *Skin lesions* depending for their existence upon general malnutrition and anemia, often yield to its use. In *enlargement of the lymphatic glands,* where they are not undergoing acute active suppuration, cod-liver oil given internally does good. This is a statement requiring explanation. By acute active suppuration is meant the early formation of pus or the molecular death of the parts—not the slow formation characterized by no active change, but represented by cold abscess or old sores. If the suppurative process is chronic, the oil does good by maintaining the patient's nutrition. In cases of *strumous ophthalmia* cod-liver oil is of great service. In advanced *syphilis* cod-liver oil is most useful, and in all stages of *rickets* it ought to be employed. So small an amount as 10 drops a day given to an infant may prevent the development of *rickets* or cause rapid recovery. In *marasmus*, when used by inunction, or given internally if the stomach will stand it, it is one of the best drugs we have. (See Vitamines, Part III.)

In *sciatica* and *lumbago* and in *neuralgia* cod-liver oil is of service, if those disorders are dependent upon anemia or an impoverished state of the system. In *emphysema of the lungs* it is said to be of value, and certain writers commend its use in *gout*, although others have asserted that it is of no value. Sometimes old persons, whose digestion is not disordered and who have no organic brain disease, complain of *giddiness*. The best treatment for this condition, in many cases, is cod-liver oil with small doses of quinine, or if these fail ergot and one of the bromides may be used.

Administration.—Owing to its disagreeable taste and smell most patients rebel against taking cod-liver oil; but these objections can, with a little persistence, be readily overcome, so that finally the patient may not object to the remedy, but actually like it. This is particularly true of young children. The secret of reaching this much-to-be-desired state lies in the use at first of doses which may be dropped into a teaspoon and the spoon then gently submerged in a glass of milk. The oil floats off onto the milk in a globule in the center of the tumbler, and if the milk be rapidly gulped down without the oil touching the sides of the glass, it will not be tasted. The first gulp must be large enough to include the oil. The oil may be taken on a full stomach, but as a general rule it is best digested if taken about two or three hours after meals, when the gastric contents are about to be passed into the small bowel, where the oil is digested; and if it be immediately followed by a little pancreatin, its digestion will be much aided. Other modes of ingestion consist in the placing of the oil in whisky or brandy, in the manner which has been described with milk. This method possesses the advantage that the alcohol by its stimulating effect aids very distinctly in the digestion of the oil. Sometimes a pinch of salt placed in the mouth before and after the oil is taken aids in masking its taste and in its digestion. (See Indigestion.) Oil of eucalyptus in the proportion of 1 to 100 of the cod-liver oil will disguise the latter's taste, but many persons dislike the eucalyptus more than the cod-liver oil. The addition of an equal quantity of glycerin, with ½ to 1 minim (0.025–0.05) of the oil of bitter almonds to each dose, is often of service. Syrup of bitter orange peel is one of the best masks to its taste. Tomato ketchup has also been used with good results. Chewing a piece of smoked herring before and after taking the oil is of value to disguise the taste in some cases. The oil is readily taken in soft capsules holding from ¼ to 1 dram (1.0–4.0). Few patients are unable to swallow such capsules if these are first made slippery by dipping them in water.

Cod-liver oil is most readily digested when given in single nightly doses after supper or after a light meal just before going to bed. After a few days it may be given after dinner, and in the course of a week after breakfast. If the patient is once nauseated by overdoses, it is almost impossible to make the stomach retain the oil. If there is difficulty in digestion, a dram of ether aids in its absorption or a drink of whisky or brandy may be used instead. Often a simple bitter, such as a dessertspoonful (8.0) of compound tincture of cardamom, taken in water immediately after the oil is swallowed, aids in its digestion.

A large number of preparations of cod-liver oil are on the market in emulsion, pancreatized, and purified until they are nearly tasteless. *Emulsion Olei Morrhuæ* containing 50 per cent of oil, given in the dose of 2 to 4 fluidrams (8.0–16.0). Many of the permanent or perfect emulsions contain more Iceland moss or acacia than oil. The pancreatized emulsions are the best if the oil is present in sufficient quantity to do good, as the very fact of the oil being artificially emulsified adds to its value and makes it possible to put more oil into the emulsion. Oil devoid of smell is probably devoid of medicinal value, as all the peculiar properties have been "purified" out of it.

It has been suggested that cod-liver oil be given by the rectum, a full dose of pancreatin being mixed with it to increase its assimilability. This is almost useless. Sometimes creosote is placed in this injection in 5- to 10-minim (0.3–0.6) doses to prevent decomposition changes in the oil and, after absorption, to act as an expectorant.

COFFEE.

(See CAFFEINE.)

COLCHICUM.

Colchicum is the dried corm (*Colchici Cormus,* U. S. and B. P.) and seed (*Colchici Semen,* U. S.; *Colchici Semina,* B. P.) of *Colchicum autumnale,* or meadow saffron, a plant of Europe, containing an alkaloid, colchicine (*Colchicina,* U. S.), which may be still further changed into *colchiceine.*

Physiological Action.—Colchicum is a very powerful drug, and when locally applied is an irritant to the skin. Taken internally in overdose it severely irritates the gastro-intestinal mucous membrane.

According to the studies of one of the writer's students—Dr. Ferrer y Leon—the drug has little or no effect when given in moderate dose on the nervous system, circulation, respiration, or temperature, producing changes in these parts only when given in poisonous doses. In full doses it greatly increases the flow of bile, and may cause bilious vomiting and purging. Jacobi asserts that death is produced by respiratory failure, the heart continuing to beat for many minutes after respiration ceases. The violent gastro-enteritis which is present in colchicum poisoning in man certainly has much to do with the usual fatal result.

Therapeutics.—The employment of colchicum in medicine centers around its use in gout and similar states, such as *chronic rheumatism.* It is almost a specific in *acute gout,* provided that it be pushed until it causes slight griping or laxity of the bowels. How it acts is unknown. Colchicum does not seem to possess any marked beneficial effect in preventing attacks. Indeed, while it relieves one attack it often seems to hasten the onset of the next. In *acute gout* it is usually well to unload the bowels by a small dose of compound extract of colocynth with some hyoscyamus added to it to stop griping. Thus

℞—Extracti colocynthidis compositi . . . . gr. x vel xx (0.6–1.3)
Extracti hyoscyami . . . . gr. ij (0.12) —M.
Fiant pilulæ, No. vi.
S.—One as soon as threatened by an attack.

This pill is particularly needed if constipation be present and the belly hard. After this has acted, the colchicum may be given. Thirty to 40 minims (2.0–2.6) of the tincture of the seeds should be given, and 20 minims (1.3) more in twelve hours. In some cases of *subacute* or *chronic gout* or *chronic rheumatism,* iodide of potassium should be used in conjunction with the colchicum. The following may be ordered:

℞—Potassii iodidi . . . . ʒss vel ʒj (2.0 vel 4.0)
Tincturæ colchici seminis . . . . . fʒij (8.0)
Elixir aromatici . . . . q. s. f℥iij (90.0).—M.
S.—Tablespoonful (16.0) three times a day after meals. Shake well before using.

The use of colchicum in such doses as to cause severe purgation or emesis is dangerous, and should not be resorted to.

Colchicina, U. S., can be used successfully in gout in the dose of $\frac{1}{100}$ to $\frac{1}{50}$ (0.0006–0.0012) three to five times a day. There are now on the market capsules or pearls of colchicine with oil of gaultheria, each pearl containing from $\frac{1}{100}$ to $\frac{1}{60}$ grain (0.0006-0.001) of colchicine. They are very efficacious and are largely used.

Poisoning.—The symptoms of poisoning by colchicum are nausea, griping, agony in the belly, purging followed by the passing of thick mucus, with great and increasing tenesmus, profuse salivation, collapse, and death from exhaustion and gastro-enteritis. Bloody purging is almost never seen. The poisoning is one of the most painful, slow, and hopeless poisonings known, and a man taking as much as an ounce of the wine of the root or the seed is almost inevitably doomed to a terrible death. Tannic acid may be used as a partial chemical antidote, and the stomach washed out by the administration of emetics and the use of the stomach-pump. Opium is to be used to relieve the pain and irritation, and oils are to be given to soothe the inflamed mucous membrane. If collapse comes on, external heat and stimulants are to be used, and atropine may prove of service under these circumstances.

Administration.—Colchicum should never be used in substance. The extract (*Extractum Colchici,* U. S.) is given in the dose of ½ to 2 grains (0.03–0.12) and should contain about 1.4 per cent of colchicine. The fluidextract of the seed (*Fluidextractum Colchici*, U. S.) should contain about 0.4 grams of colchicine in each 100 cc., and is given in the dose of 2 to 4 minims (0.12–0.25).

The tincture of the seed (*Tinctura Colchici,* U. S., *Tinctura Colchici,* B. P.) is given in 15- to 60-minim (1.0–4.0) doses, and should contain 0.04 gram of colchicine in each 100 cc. The B. P. dose is 5–15 (0.3–1.0). The other B. P. preparations are *Vinum Colchici,* dose 10 to 30 minims (0.6–2.0), and *Extractum Colchici,* dose $\frac{1}{4}$ to 1 grain (0.015–0.06).

Colchicine (*Colchicina,* U. S.) is given in pill in the dose of $\frac{1}{100}$ to $\frac{1}{50}$ grain (0.0006–0.0012).

COLLODION.

Collodium, U. S. and B. P., is a solution of gun-cotton or pyroxylon in alcohol and ether, and is a clear syrupy fluid, smelling strongly of ether.

Therapeutics.—Collodion is used as an air-tight dressing for *small wounds* and *abrasions* and for rendering small dressings waterproof. A difficulty in its use consists in the contraction which takes place as it dries, which draws and puckers the parts sufficiently to cause not only discomfort, but also acute pain. It should be applied with a camel's-hair brush.

In *boils,* when they are beginning in a small pustule or papule with an inflamed zone, collodion painted around the spot, except at its very center, will generally abort the suppuration. If the boil has burst, this treatment is useless; but if it has not, the pus should not be liberated, but allowed to become inspissated. By this treatment and by the frequent application of a coat or two the local trouble eventually disappears. This rule applies only to certain cases, and if pain is caused by the retention of the pus, it must be evacuated with antiseptic precautions. In smallpox the flexible collodion may be used to prevent pitting.

In *gouty inflammations* of the joints an application of collodion mixed with iodine, equal parts, will often diminish the pain, although at first the suffering may be increased by this treatment.

Flexible Collodion.

Flexible collodion (*Collodium Flexile,* U. S. and B. P.) does not contract or become hard, and is generally to be preferred to ordinary collodion in the dressing of wounds.

Styptic Collodion.

Styptic collodion (*Collodium Stypticum*) contains tannic acid, and has been employed to check *small hemorrhages.* It is seldom used, and its employment is an unsatisfactory way of controlling bleeding.

Cantharidal Collodion.

Cantharidal collodion (*Collodium Cantharidatum*), which is no longer official is identical with *Collodium Vesicans*, B. P., and is used instead of the cerate of cantharides.

COLOCYNTH.

Colocynthis, U. S., contains an alkaloid, colocynthine and a resin. Neither of these is used in medicine. Colocynth causes large watery evacuations, and may, in very large dose, produce fatal gastro-enteritis. It is official in the B. P. as *Colocynthidis Pulpa*.

Therapeutics.—Colocynth is never used alone, but always in combinations with other drugs of its class as a *hydragogue cathartic*.

In cases of *chronic dropsy* and for the relief of *serous effusions* this drug is generally given in the form of the compound extract of colocynth (*Extractum Colocynthidis Compositum*, U. S. and B. P.), which contains 160 grams of extract of colocynth, 500 grams of purified aloes, 140 grams of the resin of scammony, 50 grams of cardamom, and 150 grams of soap. In the dose of 5 to 20 grains (0.3–1.3) this acts as a powerful watery purge useful in dropsy. The extract (*Extractum Colocynthidis*, U. S.) is given with other drugs in the dose of 2 to 5 grains (0.12–0.3) as a purge. The following is a useful form in which to administer it:

℞—Extracti colocynthidis . . . . gr. xxx (2.0)
Extracti belladonnæ foliorum . . . . . gr. ij (0.1)
Extracti nucis vomicæ . . . . gr. ij (0.1).—M.
Fiant pilulæ, No. x.
S.—One each morning.

Colocynth is one of the principal ingredients in compound cathartic pills (*Pilulæ Hydrargyri Chloridi Mitis Compositæ*, U. S.). Each pill contains: compound extract of colocynth, about $1\frac{1}{3}$ grains (0.08); resin of jalap, about $\frac{1}{3}$ grain (0.02); and calomel, about 1 grain (0.06); gamboge, about $\frac{1}{4}$ grain (0.015). This pill is not to be used constantly, as it eventually makes the bowels more constipated than before. The U. S. P. of 1900 also ordered a pill (*Pilulæ Catharticæ Vegetabiles*) which contained compound extract of colocynth, extract of hyoscyamus, resin of jalap, extract of leptandra, resin of podophyllum, and oil of peppermint. This was given in the dose of 1 to 2 pills and should not have been dropped.

The preparations of the B. P. not official in the U. S. P. are: *Pilula Colocynthidis Composita*, composed of colocynth-pulp, aloes, scammony, sulphate of potassium, and oil of cloves, dose 5 to 10 grains (0.3–0.6); *Pilula Colocynthidis et Hyoscyami*, dose 5 to 10 grains (0.3–0.6).

CONDURANGO.

Condurango is the bark of *Condurango blanco*, a tree of Colombia, South America. Martindale and Westcott state it is *Gonolobus con-*

durango. It was introduced into medicine in 1873 as a cure for *gastric cancer,* and at one time had a favorable reputation. It is now known that, so far as the morbid growth is concerned, its action is valueless, but there is no doubt that it diminishes the severity of the symptoms in many cases by exercising a favorable effect on the gastric mucous membrane. It also tends to relieve the accompanying gastric catarrh through its action as a stomachic.

The bark is never employed as the bark, but in the form of the fluid extract, dose 1 to 2 drams (4.0–8.0), or the wine, dose ½ to 1 ounce (16.0–30.0). Sometimes it is given in the form of a decoction made by adding 1 part of the bark to 8 parts of water, which is given in the dose of 1 tablespoonful (16.0) three times a day. Often it is advisable to add to the prescription a little hydrochloric acid to take the place of the natural acid of the stomach, which is usually lacking in such cases.

CONVALLARIA.

Convallaria is derived from the rhizome and root-stalks of *Convallaria majalis.* It is employed in medicine as a cardiac tonic to fulfil the indications which direct us in the use of digitalis. While by no means so valuable a drug as foxglove, it sometimes acts better in an individual case than the older remedy. The heart is not greatly slowed by it, but the drug is particularly useful in cases of *arrhythmia* and "*cardiac hurry.*"

The dose of the fluidextract is from 4 to 8 minims (0.25–0.5) three times a day. The tincture (*Tinctura Convallariæ*) is given in the dose of 5 to 20 minims (0.3–1.3). Convallamarin is a glucoside of convallaria which has been used in the dose of ½ grain (0.03) three times a day. Some clinicians think it ought to be given but once a day on account of the danger of cumulative action.

COPAIBA.

The *Copaiba* of the U. S. and B. P. is the balsam or the oleoresin of one or more South American species of *Copaiba,* and is a clear, transparent liquid of oily consistence. From it is distilled an oil which is of little value.

As copaiba is an oleoresin, the term "oleoresin of copaiba" is often used to distinguish it from the oil.

Therapeutics.—Copaiba is used for the purpose of stimulating the mucous membranes of the genito-urinary tract, particularly when they are depressed after a period of inflammation, as in the later stages of *gonorrhea.* In cases suffering from *chronic urethritis* with anemia and debility the following prescription is useful. (See also Methylene blue.)

℞—Oleoresinæ copaibæ	ʒj (4.0)
Oleoresinæ cubebæ	♏xx (1.3)
Ferri et ammonii citratis	gr. xx (1.3).—M.

Pone in capsulas, No. x.
S.—One t. i. d. after meals.

Copaiba is employed in *subacute* and *chronic bronchitis* as a stimulant expectorant. In the treatment of subacute *pyelitis*, *cystitis*, and *dysentery* it is of value. In *dropsy* due to slow renal changes it is of service as a renal stimulant and diuretic.

Administration.—Copaiba itself is given in the dose of 5 to 20 minims (0.3–1.3) in capsule or in emulsion. The oil of copaiba (*Oleum Copaibæ*, U. S. and B. P.) is given in capsule or emulsion, preferably in the former, in the dose of 10 to 20 minims (0.60–1.3) two to four times a day. Sometimes it is dropped on sugar and so administered. *Massa Copaibæ* is made by rubbing copaiba with magnesia, but this is a useless and clumsy way of using it in pill form.

The drug is eliminated in the urine, and gives the test for albumin with nitric acid.

Copaiba sometimes causes urticaria, which soon disappears on withdrawal of the drug.

COPPER.

Cuprum is never used in the form of the metal itself, but chiefly as the sulphate (*Cupri Sulphas*, U. S. and B. P.), which appears in commerce as a blue, clear, somewhat efflorescent salt. It is soluble in 2.5 parts of cold water, and 0.5 part of boiling water, but it is not soluble in alcohol.

Physiological Action.—Copper sulphate, when locally applied to a mucous membrane, acts as a powerful astringent, or on the surface of an ulcer as a mild and superficial caustic. When given in overdose by the stomach, it causes death by violent gastro-enteritis and exhaustion. Generally the symptoms do not appear for an hour, and consist in burning pain in the stomach, a coppery or metallic taste in the mouth, followed by vomiting of bluish liquids and glairy mucus. With the vomiting, purging comes on, the passages at first containing the contents of the intestine, and finally mucus and blood. Convulsions of an epileptiform character may be present, and constant and profuse salivation is not infrequent. After death fatty degeneration of the liver and kidneys has been noted, and it is not uncommon for jaundice to appear after the first twenty-four hours, if the patient survives so long. This jaundice is dependent upon changes in the blood. The treatment of the poisoning consists in the primary use of the chemical antidote, which is the *yellow prussiate of potassium*, and the administration of emollient or demulcent substances, such as sweet oil and white of eggs, followed instantly by emetics or the stomach-pump. If emesis and purgation are already active, emetics are of course contraindicated, counterirritation is to be employed over the stomach and intestines in the shape of a mustard plaster of moderate strength, and opium given to allay irritation and relieve pain.

Chronic copper poisoning is almost never seen; and, although the metal is widely used for coloring canned green vegetables, it seems to be harmless when ingested in such small amounts.

Therapeutics.—Sulphate of copper in the dose of 5 to 7 grains (0.3–0.46) may be used as a rapidly acting *emetic* which acts only upon the stomach, but not upon the vomiting center. As it is irritant, the emetic dose should not be repeated, but if emesis does not occur the sulphate of zinc or mustard should be used to empty the stomach. Indeed, it may be said of sulphate of copper that it should never be given as an emetic if any other emetic can be found. Thornton has proved in the Laboratory of Experimental Therapeutics of the Jefferson Medical College that an antidotal dose of copper sulphate given to a dog poisoned with phosphorus may produce death before the phosphorus can cause a lethal result. The drug is, therefore, a theoretical, but not a practical antidote to phosphorus. In pill form it is sometimes given in *diarrheas* depending upon ulceration of the bowels. The dose should be $\frac{1}{4}$ to 1 grain (0.015–0.06) combined with opium.

In *amœbic dysentery* sulphate of copper (2 grains to the pint), which destroys the amœbæ, may be employed for irrigation of the colon in hot solutions (105°–110° F.) once or twice a day. (See Enterocylsis for method.)

In some states of the body, particularly in *skin diseases of the dry type* and in individuals with *tubercular tendencies*, copper seems to act like arsenic, and may be used in doses of $\frac{1}{10}$ grain (0.006) or less three times a day when arsenic is not well borne. In small doses it is said to be a direct stimulant to the tissues, and to increase the firmness of the flesh and strength of the normal man. Strong claims for copper as a remedy for *anemia* have been advanced, particularly if it is employed as the arsenite of copper, when the conjoint action of the arsenic and copper produces a good effect.

Sulphate of copper in the proportion of 1 to 50,000,000 or 1 to 5,000,000 has been proved to be exceedingly valuable for the purpose of purifying water potable except for the growth of algæ, which make it foul. In these proportions it also destroys the typhoid bacillus, and it should be placed in all springs, ponds, or reservoirs which may be contaminated by these germs. In these quantities it is harmless.

Locally applied, sulphate of copper is useful, in the solid form or in powder, in the treatment of *indolent ulcers*. In *chronic conjunctivitis* or in cases of *tinea tarsi*—that is, tinea on the margin of the eyelids—a crystal of the sulphate may be drawn over the diseased spot; or a solution of 1 to 3 grains (0.06–0.2) to the ounce (30.0) of water may be dropped into the eye in *subacute conjunctivitis*. A 30 per cent solution locally applied will often heal *anal fissure*.

In *relaxed sore-throat*, as a gargle, in the strength of 4 grains (0.25 to the ounce (30.0), it is often of service.

CORPUS LUTEUM.

The yellowish body found at the site of a recently ruptured Graafian follicle in the ovary of a non-pregnant animal, usually the sow, has been introduced into medicine, in desiccated form, for the purpose of relieving symptoms associated with menstrual disturbances. Its use induces uterine hyperemia and hyperplasia of the uterine muscle as well as of its mucosa. It gives excellent results in relieving the *nervous disturbances* which are manifested during the artificial menopause due to removal of the ovaries. This substance also seems to do good in *amenorrhea* and *scanty menstruation,* particularly that occurring in overfat young women and in some cases of *dysmenorrhea* and *menstrual migraine.* It has also given good results in the *vomiting* of early pregnancy, but if the blood-pressure falls under its use more than 15 points its administration should be stopped. It is contraindicated in exophthalmic goiter.

The dose usually given is 5 to 20 grains (0.3–1.3) three times a day after meals, but, if need be, a far larger dose may be used, as it seems to be innocuous. It may be given in capsules or tablet form, or intramuscularly from ampoules containing 15 minims (1.0) of soluble extract, equivalent to 2.5 grains of the desiccated substance, once a day. It has also been used intravenously. The needle or syringe should be sterilized by boiling, as phenol impairs the drug.

It is claimed by some that the corpus luteum contains two different hormones, developing at different times in its cycle of formation, which have separate effects. One of these acts as a stimulant to the menstrual function and the other seems to control excessive menstrual flow. (See Ovarian Extract.)

COTARNINE.

Cotarninæ Chloridum, U. S., is prepared from narcotine, one of the alkaloids of opium, but its physiological effect is closely allied to that of hydrastinine, derived from hydrastis. In the form of cotarnine chloride it has been placed on the market as "Stypticin," and this is used as a remedy for oozing hemorrhages, such as *menorrhagia* and *metrorrhagia,* and as a local application in *epistaxis.* It may be given in the dose of from ½ to 4 grains (0.03–0.25) three times a day in pill, tablet, or elixir, or in capsule, or by the hypodermic syringe in the dose of 1 to 2 grains (0.06–0.12).

CREOLIN.

Creolin is a liquid cresol, a coal-tar product, possessing marked antiseptic but comparatively slight poisonous properties. It is a dark brown fluid derived from soft coal, and is of the consistence of syrup. When added to water it forms a white cloud and mixes thoroughly, forming an emulsion up to 12 per cent. of the drug.

Therapeutics.—Creolin is used as an antiseptic in the lying-in state, as a *wash for the hands* and for *vaginal irrigation.* It cannot be used as a solution in which to place instruments, as the mixture with water is so opaque as to prevent their being seen when lying at the bottom of the dish. When used as a vaginal douche it should be employed in the strength of 2 per cent. One of its properties which is of value is that it forms a slippery coating over the maternal parts during parturition. In the treatment of *cystitis* in the female, Parvin highly recommended it as a vesical wash in the strength of a 1 per cent solution, or, after the bladder becomes accustomed to its use, in a 2 per cent solution. According to Kretzschmar and others, a solution of 1 to 500, used with a syringe, is useful in *otorrhea,* 1 to 100 in nasal ulcers, and 1 to 1000 as a nasal douche in *rhinitis* when there is much discharge with the formation of crusts. Creolin has also been used as an injection in the proportion of 5 parts in 1000 of water for *dysentery* and *colitis* with success.

A useful ointment for *fetid sweating of the feet* is—

℞—Creolin	f ʒj (4.0)
Hydrargyri ammoniati	gr. x (0.65)
Acidi salicylici	gr. x (0.65)
Petrolati molli	℥j (30.0).—M.

CREOSOTE.

Creosote (*Creosotum,* U. S. and B. P.) is a mixture of phenols and phenol derivatives, obtained during the distillation of wood-tar, preferably of that derived from the beech.

Much of that sold is derived from coal-tar, and is far less useful. Chemically, creosote is almost identical with phenol; clinically, it is very different. Its toxicological action is almost identical with that of phenol, and in poisoning by creosote the same antidotes as are employed in phenol poisoning—namely, soluble sulphates—should be used, as has been proved in experiments by the author. Creosote contains 60 per cent of guaiacol and 40 per cent of creosol, not cresol. Guaiacol is sometimes used in place of creosote in the dose of 1 to 2 minims (0.05–0.10). (See Guaiacol.) Creosote is a powerful antiseptic.

According to the studies of Imbert, creosote is eliminated chiefly by the kidneys in the form of guaiacol sulphate and creosol sulphate of potassium. Elimination is not rapid, for this investigator did not find it completed for about twenty-eight hours. A small amount of the drug is eliminated by the lungs.

Therapeutics.—During the last forty years creosote has been largely prescribed in *pulmonary tuberculosis* and *chronic bronchitis,* and some of the results reached by its use have undoubtedly been of value in these affections. (See article on Tuberculosis.) It has also been inhaled from sponges with great relief, and even has been injected into the lungs by way of the trachea or through the chest-wall. In the treatment of *chronic bronchitis* creosote may be placed in boiling water and inhaled in the steam. Under these circumstances it lessens the fetor of the breath, and this method often gives more rapid relief than any other measure in the treatment of ordinary *subacute inflammation of the bronchi.* (See Inhalations.) The beginning dose when the drug is given internally is 2 to 5 minims (0.1–0.30).

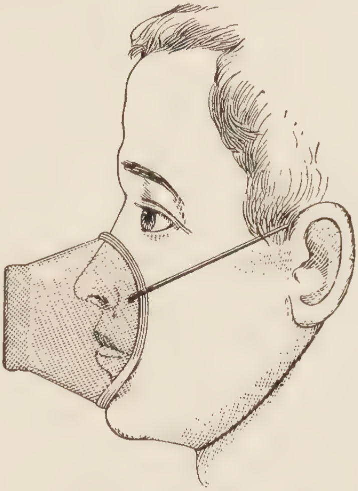

FIG. 39.—Yeo's inhaler, made of perforated zinc, bound on the edges with chamois skin, and supplied with elastic loops to go back of the ears. On a sponge placed in front of the inhaler is dropped the medicament to be inhaled.

It is useless to attempt to cure pulmonary tuberculosis by the administration of creosote, and its chief value in the disease depends upon its action as an expectorant affecting favorably the profuse bronchial secretion associated so often with the involvement of the lung tissues by the tuberculous process. Creosote does good, indirectly by relieving this complication; but it is apt to disorder the digestion. It ought not to be employed in every case, since its value in relieving the bronchial disorder is far outweighed by the disturbance of digestion in many instances. If fever or hemoptysis is present, the use of creosote is contraindicated. When it is desired to relieve profuse mucopurulent expectoration creosote may be given in capsule or as follows:

℞—Creosoti (beechwood)	fʒiij (12.0)
Tincturæ gentianæ compositæ	f℥j (30.0)
Spiritus vini rectificati	f℥viii (240.0)
Vini Xerici	Oij (960.0) —M.

S.—A tablespoonful in a wineglassful (16.0 : 60.0) of water three times a day.

In other cases the creosote may be dropped into half a glassful of milk and taken in this three times a day. Often as much as a dram a day can be given by gradually producing tolerance through ascending doses; and it is worthy of note that in most instances large doses are required if satisfactory results are to be obtained. (See article on Tuberculosis, Part IV.)

In the advanced stages of phthisis inhalations of the drug often decrease the cough, relieve the laryngeal dryness, and promote expectoration.

In the treatment of *subacute laryngitis* a fine spray of 1 to 2 minims (0.06–0.12) of creosote, 4 grains (0.25) of menthol, and 1 ounce (30.0) of liquid albolene, is of service used several times a day; or a mixture composed of creosote 10 minims (0.6), chloroform spirit 10 minims (0.6), and alcohol 20 minims (1.3), may be placed on the sponge of an inhaler and inhaled. It is also claimed that wetting cloths with creosote and hanging them in the air of a nursery are of great value in *whooping cough.* (For methods, see Inhalations, Part III.)

Creosote is a valuable remedy in cases of *indigestion* with fermentative changes in the gastric contents when these arise from the deficient digestion of meats or the use of sweets, given in the dose of ½ to 2 minims (0.025–0.1) after meals, preferably in tablet or capsule. Applied on a pledget of cotton to the cavity of a carious tooth, creosote often relieves *toothache* by virtue of its anesthetic influence over peripheral sensory nerves.

While ordinary medicinal doses of creosote rarely cause disagreeable symptoms, except some disorder of the stomach or bowels when it is given in full doses, the physician who is ordering large amounts should be always on the lookout for toxic symptoms. These consist in vertigo, headache, and a tendency to stupor, and the urine may become smoky in appearance, as in phenol poisoning. If any of these signs of overdosing appear, the drug must be reduced in dose or stopped, altogether, particularly of albuminuria develops.

The preparations of creosote are *Aqua Creosoti,* which is given in the dose of 1 to 3 fluidrams (4.0–12.0); *Mistura Creosoti,* B. P., dose ½ to 1 fluidounce (15.0–30.0); *Unguentum Creosoti,* B. P., for local application.

Creosote Carbonate.

Creosotæ carbonas, sometimes called "Creosotal," is a combination of creosote with carbonic acid. Over 90 per cent of creosote carbonate is said to be creosote. It is a thick, oily fluid of an amber color, with but little taste or odor, and is insoluble in water, dilute alcohol, and glycerin, but is soluble in 95 per cent alcohol, in ether, chloroform, and in cod-liver and olive oils. It is said to be less irritating to the stomach than creosote. The drug is dissolved and absorbed chiefly in the intestine. The dose of creosote carbonate varies from 15 to 30 grains (1.0-2.0) twice or thrice a day after meals. It is used as an expectorant in *pulmonary tuberculosis* and as an *intestinal antiseptic.* It is best given in capsule. (See also Guaiacol, Carbonate of.) It has been claimed that this drug possesses great virtue in cases of croupous pneumonia, but careful clinical research has failed to show that this is true.

CROTON CHLORAL.

Croton chloral, or *Butyl Chloral Hydras,* B. P., has a physiological action closely allied to that of chloral itself, but it possesses more analgesic power and is much less depressant to the heart and circulation. The dose for the production of sleep is the same as chloral, 5 to 20 grains (0.3–1.3) in syrup and water.

Therapeutics.—Croton chloral is preferable to chloral in sleeplessness due to pain.

In *facial neuralgia* and *migraine* it is exceedingly efficacious, particularly if the fifth nerve be involved. In *headaches* due to *eye-strain,* and in those associated with *sick stomach,* but not due to gastric indigestion or nervous debility, croton chloral is of service. Curiously enough, it is valueless in toothache, but is useful in the neuralgia due *to decayed teeth.*

Administration.—Croton chloral should be used in pill form in the dose of 3 to 5 grains (0.2–0.3) every two hours until the pain is relieved or sleep comes on, or it may be given in solution or syrup of acacia and water, or water and glycerin. It has been used in as large a dose as 60 grains (4.0), but 20 to 30 grains (1.3–2.0) ought to be the maximum dose as a general rule.

CROTON OIL.

Croton oil (*Oleum Tiglii,* U. S.; *Oleum Crotonis,* B. P.) is an exceedingly irritant oil derived from *Croton tiglium.* Applied to the skin for any length of time, it is an intense irritant, producing blisters or pustules. One minim (0.06), placed on the tongue with 5 minims (0.3) of sweet oil, acts as a violent watery purge, and, owing to the smallness of its dose, has been frequently employed to *revulse* the *unconscious,* as in *cerebral congestion.* In *delirium* it is used for the same purpose, and may be given to maniacs who are suffering an attack of *cerebral congestion* or *obstinate constipation,* owing to the smallness of its dose and rapidity of action. The dose is 1 minim (0.06) placed on the tongue with sweet oil or given in emulsion or in pill. It should never be used when there is any irritation of the stomach or bowels. As a counterirritant it is sometimes applied over a tender nerve or to the chest in the treatment of *bronchitis,* in the proportion of half-and-half with sweet oil. Thus applied, it may be absorbed and cause purging. The treatment of poisoning by croton oil is identical with that of gastro-enteritis. (See Gastro-enteritis.) *Linimentum Crotonis* is a preparation of the B. P. which is employed as a counterirritant liniment for *sprains* and in *muscular rheumatism.*

CUBEBS.

Cubebs (*Cubeba,* U. S., and *Cubeba Fructus,* B. P.) are the unripe fruit of *Piper cubeba,* a plant of Java. Overdoses of cubebs cause gastro-intestinal and genito-urinary inflammation.

Therapeutics.—Cubebs are used in the advanced stages of *gonorrhea* when a tendency to a chronic discharge is present. Some surgeons have used them in the early stages as an abortive treatment, but this is a bad practice. In *cold in the head* the powdered berries may be snuffed up the nostril when the stage of secretion is well established. They ought not to be used before this stage. In the treatment of *chronic or subacute bronchitis* the oleoresin of cubebs is very useful in some cases (see Bronchitis), and in the form of cubeb cigarettes the drug is much used as a remedy for hoarseness due to subacute laryngitis.

Administration.—Cubebs may be given in powder in the dose of 10 to 60 grains (0.6–4.0), as the fluidextract, 10 to 30 minims (0.6–2.0), and in the form of the tincture (*Tinctura Cubebæ,* B. P.) in the dose of 10 minims to ½ ounce (0.6–16.0), ½ to 1 fluidrachm (2.0–4.0), B. P.

The dose of the oleoresin (*Oleoresina Cubebæ,* N. F.) is 2 to 20 minims (0.1–1.3) three times a day, and it may be given in capsule or emulsion. The troches of cubebs are used for the relief of *pharyngitis* of a chronic type. The dose of the oil (*Oleum Cubebæ,* B. P.) is 5 to 20 minims (0.3–1.3).

DEXTROSE.

Dextrose or *Dextrosum,* U. S., otherwise called d-glucose is to be definitely separated from glucose U. S. P. Dextrose represents complete starch hydrolysis whereas glucose represents starch partly hydrolyzed, and contains maltose, dextrin and water.

Dextrose appears as a white crystalline powder or in granules. Glucose, often called corn syrup, appears as a syrupy liquid. Glucose should not be used if dextrose is obtainable, unless it is to be taken by the stomach, and in many instances it is best to use dextrose even if this method of administration is resorted to or if not dextrimaltose. When given intravenously, intramuscularly or intra-abdominally dextrose should always be employed. Medical literature almost always uses the term glucose. This word should be displaced by dextrose for the reasons just given.

It is possessed of high nutritional value and has come to be used largely as a means of providing nutrition in the threatened *coma of diabetes,* in *starvation,* due to any condition in which the digestive tube is disordered or diseased, as in the presence of *pernicious vomiting,* and in *puerperal eclampsia* when *ketosis* is present. So, too, it is valuable in cases of feeble heart. It is commonly employed by surgeons in the preparation of feeble patients for immediate operation and after operation to support the system and to combat shock, in which case insulin is given subcutaneously in the proportion of 1 unit to 5 grams of dextrose. When given intravenously, as is commonly done, it is essential that the dextrose should be specially prepared. It is to be recalled that whereas salt solution is isotonic with the fluids of the body at 0.9 per cent or 9 grams per 1000, dextrose solution is isotonic between 4.5 and 5 per cent, or 50 grains per 1000 cc. (For importance of regarding isotonicity, see article on

Intravenous Injection, Part III.) It is essential that the solution be properly buffered and sterile. If overheated in the process of sterilization caramelization will take place, which is revealed if the solution darkens in color. In an emergency sterile water containing 10 to 15 per cent of dextrose may be rapidly brought to the boiling-point by exposing the flask containing it to the heat of a Bunsen flame for three minutes with shaking of the flask. When needed frequently it is best to obtain the dextrose solution already prepared and put up in sterile glass ampoules of from 20 to 50 cc. of 50 per cent strength which may be diluted with doubly distilled sterile water to a strength of 25 per cent for intravenous injection and given very slowly, because if given rapidly the dextrose is eliminated by the kidneys. If a solution of 25 per cent is employed its injection should cover at least fifteen minutes and twice that period if a 50 per cent solution is used. There is some evidence that normal salt solution aids in the passage of the dextrose through the capillary walls and the contents of one of the ampoules just named is often given mixed with 100 to 500 cc. of normal saline, the larger amount being used if the patient is dehydrated. Some practitioners use as much as 1000 cc. with or without insulin. If given very slowly indeed over many minutes, the 50 per cent solution undiluted may be injected, using one-half the ampoule content. One injection a day is adequate as a rule, the quantity given being in the proportion of 5 cc. to the kilo of body weight, if these strong solutions are employed, whereas if a solution of 5 to 10 per cent is used, 20 cc. per kilo are given. (For directions, see Intravenous Injection, Part III.) In grave cases of diabetes, insulin is to be given intramuscularly to aid the body in utilizing the foodstuff and 1 unit for each 5 grams of dextrose is usually sufficient, except in diabetic coma when insulin in the proportion of 1 unit to each 2 or 3 grams of dextrose is better. (See Insulin, Part II.)

If it is desired to use dextrose with sodium bicarbonate a mixture of 5 per cent dextrose with 1.5 sodium bicarbonate may be employed. This makes a double isotonic or hypertonic solution it is true, but the dextrose is so quickly burnt up or stored as glycogen that the tissues are not dehydrated.

(For dextrose in infant feeding, see Foods for the Sick.)

DIAL.

Dial is a trade name for diallylbarbituric acid. It is a combination of two molecules of barbituric acid with the allyl radical (C_2H_4) differing therefore from barbital in which the ethyl radical occurs. It is important to remember that as it lowers blood-pressure it must be used with care in persons with a feeble circulation. It is without doubt an efficient hypnotic in cases of *nervous insomnia* given in the dose of 1 to 3 (0.06–0.20) grains in pill, tablet or capsule. Dial is also placed on the market in the form of an elixir of which each dram equals ½ grain. It is to be noted that its dose is much less than that of barbital. Dialacetin is a compound of dial and acetphenetidine used to *relieve pain* and in *epilepsy* as is a similar compound with amidopyrin in place of acetphenetidin called Cibalgine. In patients who, because of kidney disease, have faulty elimination, this drug when it is given to cause sleep often causes a state of torpor on the following day. Its lethal toxicity is, however, very low since cases are on record in which recovery has followed the ingestion of 50 tablets of 1½ grains, the patients sleeping sixty hours before waking.

DIASTASE.

The word diastase (*Diastasum*) is applied to substances found in certain of the digestive juices of the animal body and present in processes connected with the fermentation of grain, as, for example, in the manufacture of alcoholic beverages. Whatever diastase may be, we recognize that it belongs to the same class of enzymes as pepsin and pancreatin, and that it has the power of converting starch into dextrin. Many preparations of malt contain some diastatic power, but there is only one preparation of diastase which possesses no other property save that of aiding the digestion of the starches—namely, one prepared originally by a Japanese investigator, Takamine, and called from his name "Taka-diastase." It is used to relieve cases of *indigestion* of starchy foods in the dose of 2 to 5 grains after meals, in tablet or capsule or in a solution, and is a most efficient remedy.

A useful formula is as follows:

℞—Taka-diastase	gr. xlv (3.0)
Pancreatini	gr. xlv (3.0)
Extracti nucis vomicæ	gr. iv (0.25).—M.

Pone in capsulas, No. xx.
S.—One capsule with meals.

Often a little capsicum may be added to this prescription, in the treatment of *atonic dyspepsia*, with advantage.

In the artificial feeding of infants it is often necessary to largely dilute the cows' milk and equally needful to maintain its nutritional value. This can be accomplished by adding barley gruel which has been strained and then largely converted into dextrin or maltose by adding taka-diastase to it while it is still warm, but not boiling hot. The diastase can be destroyed after its effects are induced by bringing the gruel to the boiling-point for a few moments.

Taka-diastase, in the dose of 5 to 10 grains (0.3–0.6) three times a day, sometimes decreases the loss of sugar, and, more frequently, greatly diminishes polyuria in *diabetes mellitus*.

DIBROMIN.

Dibromin is prepared by a special process from bromine and barbituric acid, and bears the chemical name of dibrom-malonylureide. It appears as a white powder, crystalline in character, almost odorless, and is soluble in water between 3 and 4 per cent but insoluble in oils. When in solution it gradually undergoes decomposition.

Dibromin is used as an antiseptic by virtue of the fact that when in contact with the tissues it slowly parts with its bromine, which is germicidal. It does not coagulate albumin. It would appear to be particularly destructive to the *Streptococcus hemolyticus.*

The solutions used vary from 1 in 10,000 to 1 in 500, the weaker strengths being used if efficient. Thus in gonorrhea a 1 to 2500 to 1 to 1250 may be advantageous. Irrigation strengths in infected areas are usually about 1 in 2500. Dibromin is put up in capsules of definite strength, so that solutions may be readily made by emptying the contents into a known quantity of water. Thus the contents of 1 capsule in 1 gallon of water equals 1 to 10,000.

DIGITALIS.

Digitalis, U. S., is the dried leaves of *Digitalis purpurea,* Linné, or Foxglove, collected from plants at the commencement of flowering. The leaves are official in the B. P. as *Digitalis Folia.* It contains a number of substances, no single one of which acts as do preparations of the crude drug. In other words, all these compounds must act together to produce therapeutic effects similar to those obtained when digitalis leaves are given. Among the substances so far isolated from digitalis by chemists may be named digitalin, digitalein, digitoxin, digitin, and digitonin. Several of these are probably compounds of the others. Digitalin, so-called, occurs in two forms, amorphous and crystalline. The crystalline digitalin (Nativelle, French) is largely digitoxin, while the amorphous form is composed of digitonin, digitalein, and digitalin. German digitalin is about 50 per cent digitonin and 6 per cent true digitalin. Digitoxin and pure digitalin are the two most active principles yet found. None of these substances should be used in medicine to take the place of digitalis, but crystalline digitalin and digitoxin may be used as a heart stimulant. (See Administration.)

In the early part of this volume the necessity of employing reliable drugs was pointed out. In the instance of digitalis this is particularly important, because the cases in which it is used are often serious, and because digitalis varies greatly in strength. American grown digitalis is quite equal to that which is imported. The preparations of digitalis should therefore be obtained from a reputable manufacturing pharmacist after they have been physiologically tested.

Physiological Action.—Digitalis is apt to irritate mucous membranes which are already slightly out of order, and for this reason should not be given by the mouth in large doses in cases of gastritis and allied states if it can be avoided.

Nervous System.—The action of digitalis upon the nervous system is only manifested when poisonous doses are used and the symptoms are due to the disordered circulation. (See Poisoning by.)

Circulation.—Upon the circulatory system digitalis exerts its chief influence. In moderate or medicinal amounts it increases the pulse-force and arterial pressure, slows the pulse, and increases the size of the pulse-wave. The increase of pulse-force is due to a stimulating influence exercised upon the muscular fibers of the heart. Gottlieb and Magnus have shown this to result in the doing of two and a half times the normal amount of work.

Not only does digitalis stimulate the ventricular wall to greater effort, and restore its tonicity when this is impaired, but the prolongation of the period of diastole permits the heart to regain its irritability, contractility, and also the conductivity of its muscular fibers. The longer the diastole, therefore (diastole being the period of resuscitation), the greater the power of the next contraction. (See below.)

The rise of arterial pressure is caused by the increase in pulse-force and pulse-volume, and by stimulation of the vasomotor center and the muscular coats of the bloodvessels, whereby constriction occurs in the walls of the arteries and arterioles. Some recent investigations on human beings by means of the sphygmomanometer seem to indicate that a rise in pressure often fails to take place, but while this may be true in cases in which the pressure is normal or above normal it is not true in all cases of low pressure due to ruptured compensation in valvular disease. At times the drug may in a case of impaired circulation lower the pressure, since by improving the circulation in the medulla and in the lungs it may cause an increased elimination of CO_2, which in amounts which are not very excessive may raise pressure and so increase the work of the left side of the heart. So too by relieving cardiac dyspnea and diminishing labor in breathing it may lower a high blood-pressure induced by such vigorous exercise.

The slow pulse is produced by stimulation of the pneumogastric center and by increasing the conduction time in the atrio-ventricular node and over the bundle of His. The increase in the volume of the pulse is due to a more complete contraction than normal and to the influence on the vagi; for, the pneumogastric center being stimulated, the diastole of the heart is more full and complete and occupies a greater length of time. The result of this delay is that the ventricles become thoroughly distended, and on contracting drives out a much larger wave of blood through the pulmonary artery and the aorta than is normally sent out (Figs. 40 and 41). This is important to remember when using the drug in heart disease and other states.

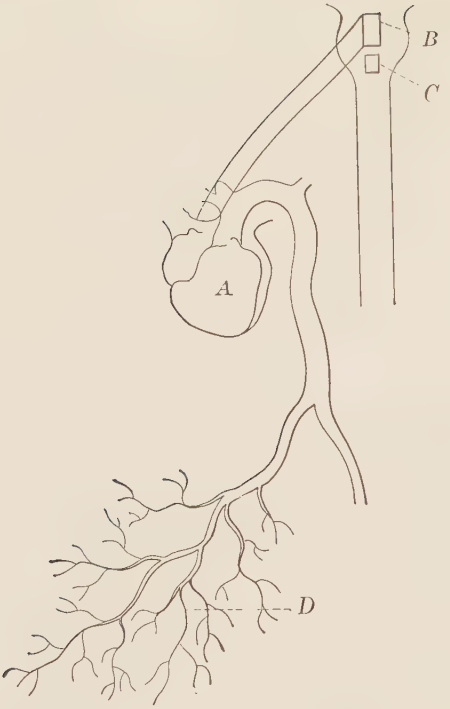

FIG. 40.—*A*, digitalis stimulates the heart; *B*, stimulates the vagus centers; *C*, stimulates the vasomotor center; *D*. stimulates the walls of the bloodvessels.

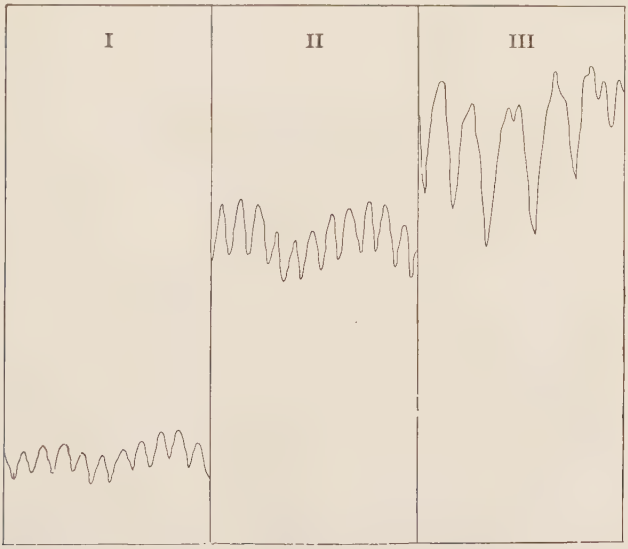

FIG. 41.—Showing the effect of digitalis on the circulation: *I*. Before digitalis was used: blood-pressure 86, pulse 21 in ten seconds. *II*. After the use of digitalis: blood-pressure 150, pulse 22 in ten seconds. *III*. Another dose: blood-pressure 164, pulse 20.

Some of the investigations made on cardiac action have seemed to point to the view that the increase in the volume of blood expelled at each beat under digitalis is due to the fact that the ventricles more completely empty themselves, and this, in turn, is due to the fact that increased vagal influence results in a longer period of rest and in the accumulation of greater cardiac contractility.

While it is not known that the vagi are the trophic nerves of the heart, there is a large amount of evidence in favor of such a view, and it has long been thought that digitalis was not only a heart stimulant, but a remedy that increased the growth of its muscular tissue as well. If the trophic nerves of the heart are stimulated by digitalis, it becomes evident that it is a doubly useful remedy.[1] (See article on Heart Disease, in Part IV of this volume, for a further explanation of the influence of digitalis in improving the nutrition of the heart muscle.)

When full medicinal doses of digitalis are frequently repeated, or when poisonous doses are ingested, the action of the heart may become exceedingly irregular. (See Poisoning.) This irregularity may be explained as follows: In health the contraction-wave in the heart arises in the sino-auricular node and passes over the walls of the auricles to the auriculo-ventricular junction, where it is transmitted by the bundle of His to the ventricles in regular sequence. If any cause interferes with the normal transmission of the contraction wave from the auricles to the ventricles incoördination between these parts of the heart develops. If a regular sino-auricular impulse reaches the ventricle a normal heart-beat occurs, but if it fails to reach the ventricle this part of the heart does not contract or, if it does contract, it originates its own contraction impulse, and, therefore, the ventricular contraction becomes entirely independent of auricular contraction, both in its origin and in its time, with the result that the ventricle may contract only half the number of times per minute that the auricle contracts.

A toxic amount of digitalis may produce this condition in the following manner: Through its influence on the vagi, it distinctly interferes with the passage of the contraction wave over the bundle of His, although digitalis does not seem to directly affect this bundle. As a result, some or all of the contraction waves arising at the sino-auricular node fail to reach the ventricle and incoördination results. Second, the digitalis stimulates the ventricle to increased activity, and this aids in the production of extra systoles when the ventricles beat independently of the auricles.[2] Auscultation of the heart will reveal many beats, some of which are evidently normal, except that they may be unduly deliberate. Other beats are abortive, with the result that the heart sounds seem jumbled and irregular as to rhythm and force. The radial pulse may be much less frequent than the apex beat, because the extrasystoles may not have sufficient blood and force to produce a pulse at the wrist. The development of extrasystoles or of dropped beats when digitalis is being freely used should

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[1] In an original study by the author he found that when digitalis is given continuously for a long period of time there results cardiac hypertrophy independently of any valvular lesion. See Therapeutic Gazette, December, 1897.

[2] In some of the earlier editions of this book I have ascribed the irregular action of the heart under digitalis to a struggle between its vagus effect and its muscle effect. Better knowledge as to His' bundle, as just given, seems to confirm this earlier view, now expressed in different terms.

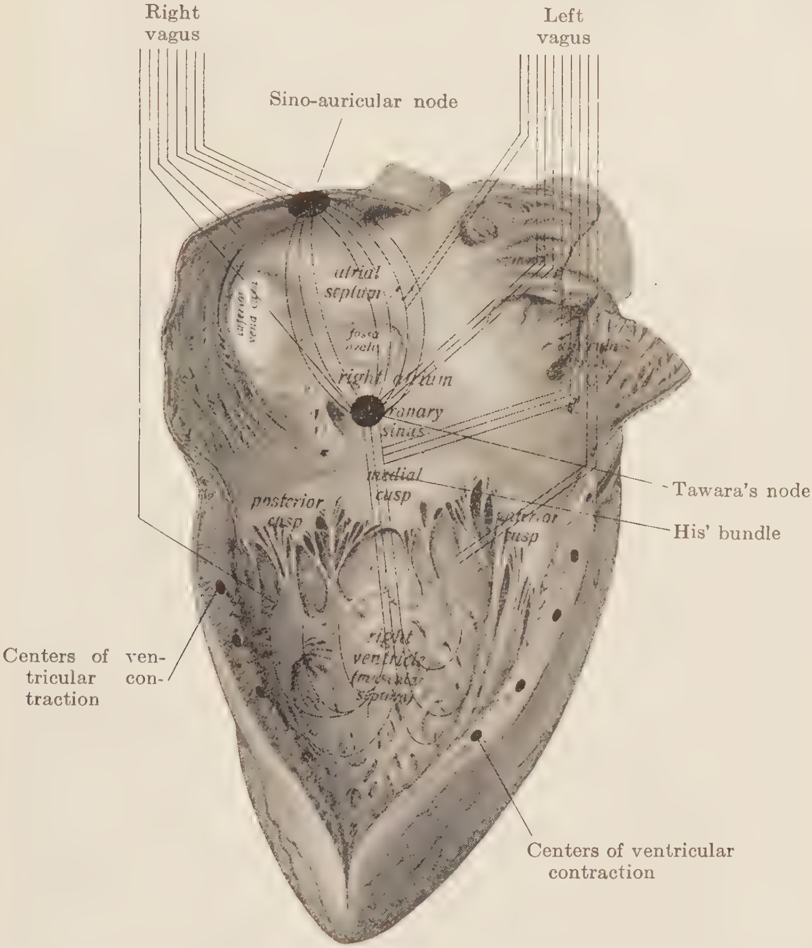
Right vagus
Left vagus
Sino-auricular node
atrial septum
fossa ovalis
right atrium
coronary sinus
medial cusp
posterior cusp
anterior cusp
right ventricle
Tawara's node
His' bundle
Centers of ventricular contraction
Centers of ventricular contraction

Fig. 42.—Right side of the heart showing diagrammatically the distribution of the two vagus nerves to different parts of the viscus. The impulse to contraction originates at the sino-auricular node and passes over the wall of the auricle to Tawara's node, and thence over His' bundle across the auriculo-ventricular septum to be distributed throughout the ventricular wall. If the upper, sino-auricular, node is damaged, or if its impulses fail to get across the wall of the auricle, Tawara's node acts in its place to start off the ventricle. If a lesion at the base of the mesial segment of the tricuspid valve damages His' bundle, so that Tawara's node is cut off from the ventricle, then the ventricle may originate its own impulses to contraction.

cause the physician to stop its administration at once. When the action of the heart is rapid and tumultuous after very full doses of digitalis Cushny pointed as long ago as 1897 that the drug has induced auricular fibrillation. This is the more interesting because digitalis is in large doses often the best remedy in auricular fibrillation with ruptured compensation. So, too, if the electrocardiograph reveals an inverted T-wave in Leads I and II it is to be recalled that this may be due to excessive doses of digitalis, but in most instances it is due to myocardial disease. (See Heart Disease, and especially Mitral Stenosis.) Sometimes a distinct jugular pulse is readily observed which may be synchronous with ventricular contraction, because the right ventricle forces the blood backward through the right auricle. The irregular pulse, caused by an excess of digitalis, is sometimes replaced by an exceedingly rapid pulse, which is shuttle-like in character, and, whether the pulse be irregular or rapid, the arterial pressure may be, at this time, low, owing, first to the imperfect action of the heart, and, second, to a depression of the vasomotor centers and the muscular coats of the bloodvessels. The rapid pulse, when it occurs, is probably due to a depression of the peripheral ends of the vagus nerves.

Often when the patient has received too much of the drug the finger can scarcely note any pulse at the wrist, yet the ear when placed over the heart finds it to be beating forcibly but abortively. It is important that the weak pulse at the wrist be not taken as the only guide as to the state of the patient for this very reason, and the physician should always auscult the precordium before reaching an opinion as to the action of digitalis.

If a patient who has taken a poisonous dose be suddenly placed in an upright posture, death may ensue, owing to the disturbance of the contraction wave in the heart produced by the erect posture. Under these circumstances the heart beats so abortively that the circulation fails, the condition produced being like that of complete heart-block arising from a lesion in His' bundle, as in Stokes-Adams Disease.

Respiration.—Digitalis has almost no effect on this function unless the amount be poisonous, when respiration is slowed.

Temperature.—Upon the normal bodily temperature digitalis has little or no effect in medicinal dose. In poisonous dose it lowers temperature. In fever the drug seems to cause a slight fall with some constancy, but it can rarely be used for any antipyretic influence. *High temperatures prevent digitalis from slowing the pulse*, because, as proved by Brunton and Cash, fever depresses the vagus centers in the medulla, and also in all probability, when the temperature is very high, the peripheral ends of the vagus. This is an important point to be remembered in the therapeutic use of this drug.

Kidneys, Tissue-waste, and Elimination.—Digitalis has almost no effect upon the kidney structure itself, and does not to any extent stimulate the renal epithelium. The cause of the increased urinary flow produced by digitalis in cases of cardiac dropsy depends upon the removal of congestion of the kidneys and the increased arterial pressure and improved circulation brought about by the drug.

It is important to remember that digitalis, if given in overdose, may cause a spasm of the bloodvessels of the kidney, and so cause suppression of urine. This is usually accompanied by the development of cumulative effects.

Upon tissue-waste digitalis seems to have little effect, but there is still some discrepancy in the reports as to the amount of urea excreted under its use, some investigators saying it is increased, others that it is diminished.

It is not known how the drug is eliminated, as chemists have never been able to detect it in the urine. It is probably oxidized in the body.

Therapeutics.—Much misunderstanding concerning the action of digitalis has arisen, and, while some call it a circulatory stimulant, others think it a circulatory depressant. The first class base their belief on the signs of increased arterial vigor and cardiac power, the others on the fact that it slows and steadies an irritable, rapidly acting heart but overlook the other signs. *Digitalis is a cardiac stimulant and not a sedative,* but by slowing its beats it rests the heart; for it is to be recalled that although the heart is never at rest, as are other muscles, its total period of rest in twenty-four hours is about one-third longer than its period of activity, because the systole lasts about 0.379 seconds and diastole 0.483. When a heart is beating rapidly the period of systole is not much shortened, the time being taken from that of diastole or the period of rest. (See Heart Disease, Part IV.)

Its chief field of usefulness is in cases of *ruptured compensation in valvular* disease and in *auricular fibrillation,* provided there is rupture of compensation. The mere existence of a murmur does not indicate its employment.

In *auricular fibrillation* digitalis does good by cutting off or blocking the showers of impulses which would otherwise pass to the ventricles and so fatigue or exhaust the heart muscle. It also, by supporting the right ventricle, sends the blood much better through the lungs and by this same effect aids both ventricles in maintaining their contractility, irritability and conductivity. The object of the physician, so far as physical signs go, is to reduce the pulse deficit. When first seen the apex-beat may be 120, but the radial pulse only 70—a pulse deficit of 50. As the drug controls the heart the apex-beat may drop to 100 or 90, and the radial pulse remain at 70—a pulse deficit of 30 or 20. When the best results are secured there is no pulse deficit, that is, the apex-beat and the radial pulse are identical in speed. Rest in bed and large doses are needful in these patients (Fig. 43).

When used in *auricular flutter* this state is usually changed to fibrillation, and then on the stopping of the digitalis the heart returns to its normal action instead of flutter. (See Heart Disease, Part IV.)

Digitalis is of value in nearly all cases of cardiac disease where the condition is one in which the heart fails to do its proper amount of work unless the failure is due to myocardial degeneration. The degree of failure of digitalis in such cases is, of course, in direct proportion to the degree of degeneration. If there is complete heart block digitalis may do good by stimulating the ventricle to more rapid beats. If partial heart block is present it is dangerous to give full doses of digitalis since it may cause a sudden onset of complete block and death. An accurate diagnosis can be reached only with the aid of the electrocardiograph. If simple hypertrophy or excessive compensatory hypertrophy exists it is harmful. It is of less value in aortic regurgitation than in any other lesions, because the prolongation of diastole allows greater opportunity for the blood to fall back into the ventricle, although in the second stage of this lesion, when the mitral orifice and valves are beginning to give way, or the left ventricle is tiring out, it is often very useful. In rare instances of mitral regurgitation the drug does harm by overdistending the auricle through ventricular stimulation, which results in an increase in the regurgitant flow, and we can never tell before trying it which cases will be so affected. (See Heart disease.[1]) In cases where the heart is *irritable, palpitation* present, and indigestion not the cause of the trouble, digitalis is of service. It is also useful in *cardiac dilatation* and *asthenia*, and in that condition which J. M. Da Costa called a "*tired heart.*"

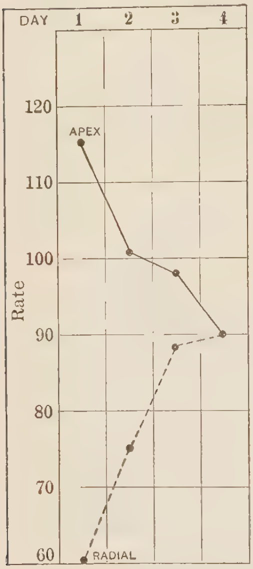

Fig. 43.—Auricular fibrillation with slight decompensation. First day apex-beat, 115, radial pulse, 60, pulse deficit, 55. Fourth day apex-beat, 90, radial pulse, 90, pulse deficit, nil. Effect produced by full doses of tincture of digitalis. As symptoms of cardiac failure disappeared digitalis dose was cut on fourth day by one-half and effect maintained.

In the *second stage of pneumonia* if the heart is laboring and unable to do its work properly, digitalis is often invaluable (see Pneumonia). In *congestion of the lungs* in typhoid states it will drive out the blood from the part congested and relieve stasis unless the heart muscle is degenerated.

In *cardiac weakness* from *collapse, injury, poisoning,* or *shock* digitalis may be used. In *aconite poisoning,* it is the physiological antidote. Owing to its tardy action it should, however, be preceded by ammonia and strychnine where the need is pressing. In *poisoning* by poisonous mushrooms digitalis and atropine are the antidotes.

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[1] It is absolutely necessary for the student to turn to the article on Heart Disease, (Part IV), and to read it carefully, in order to understand the action of digitalis in disease.

As a *diuretic* digitalis is most useful when the *kidneys are congested* and the circulation is sluggish from cardiac feebleness. When the renal structure is diseased, other drugs should take its place, or it should be combined with more active renal remedies, such as calomel squill or caffeine.

Untoward Effects.—Digitalis sometimes causes nausea and vomiting if pushed in large doses. It has been claimed that this is not due to irritation of the stomach, but to an effect on the vomiting center in the medulla induced apparently by impulses which pass through afferent sympathetic fibers and afferent vagus fibers when the heart is overcome by the drug, but more recently this has been denied by Dresbach and Waddell. So too full doses of digitalis are prone to cause hyperchlorhydria and increased gastric motility. In children it is likely to produce marked irregularity of the pulse. When given in full doses the patient should always remain in bed and not be allowed to sit up suddenly, as syncope may occur. It is particularly important that this rule be enforced if the patient desires to empty the bladder, for cases are on record in which a patient has risen suddenly, emptied the bladder and fainted or even died in syncope.

In some cases a *cumulative action* occurs, which consists in a sudden development of the effects of the drug to an excessive degree, so that the symptoms resemble those seen after a poisonous dose has been taken. This is particularly prone to occur when ascites or dropsy is removed by tapping after the drug has been taken for a long period. It is thought that the sudden withdrawal of pressure upon the great vascular trunks of the body cavities causes the absorption of the drug with the fluids of the tissues where it has remained inactive. Such an accident also sometimes occurs when a fever ends by crisis and digitalis has been given. It also takes place whenever full doses are given so frequently as to be in excess of elimination, for the drug is slowly eliminated, and so rapidly accumulates in the body. Cumulative action is often preceded by a scanty passage of urine. A decrease in the quantity of the urine when digitalis is being freely used should cause the physician to stop its administration or be most cautious in its continuance. Pardee has estimated the drug is destroyed in the body at the rate of about 22 minims of the tincture per day.

Poisoning.—The slow, full pulse followed by the hobbling, dicrotic, shuttle-like pulse-beats, and the tumultuous cardiac beat, afford a combination of symptoms characteristic of the overaction of digitalis. The pulse may be full and slow when the patient is recumbent, but at once becomes irregular on his sitting up.

As the poisoning progresses vomiting may come on, exophthalmos occurs, and a peculiar blue pearliness of the sclerotic is seen. Consciousness is generally preserved nearly to the last. Death from digitalis poisoning may not take place for days or may occur in two hours or even less. Headache is often a severe symptom.

Treatment of Poisoning.—Tannic acid is to be given as a chemical antidote; emetics and the stomach-pump are to be used, the former only when the drug has not been absorbed, for if the heart is much affected emetics are dangerous. External heat is to be applied, particularly about the abdomen. The maintenance of a horizontal position must be insisted upon, for several days after active symptoms have subsided sudden death on sitting up has occurred. The use of tincture of aconite, as the physiological antidote, and full doses of atropine may be resorted to.

Contraindications.—In cases of marked atheroma of the bloodvessels, in aneurism and in patients who have suffered from apoplexy digitalis must be used with care because it increases circulatory vigor. On the other hand, by resting the heart, it may do good in many of these patients, particularly if combined with Donovan's solution.

Administration.—When digitalis is to be used as a cardiac supportant the physician should pursue a definite plan of action based on the knowledge that it is very slow in producing its effects and persistent when once its influence is established. Even when taken into a healthy stomach which is empty it is one or two hours before its influence is marked and about six to eight hours before its effect is at the maximum. At least thirty-six to forty-eight hours elapse before the heart may be considered as digitalis-free from one large maximum dose. If a heart in an adult is in a bad way as a result of decompensation, and no digitalis has been used recently, it is often wise to give as much as ½ to 1 minim of the tincture for each pound of the patient's weight, unless the weight is excessive because of dropsy. That is, from 1 to 2 drams at the dose and no more for twenty-four or forty-eight hours, when the effect may be maintained by 15 to 20 minims (1.0–1.3), three times a day or even less frequently, care being taken that a toxic effect is not induced. (See Heart Disease.) When the electrocardiograph can be used it should be employed to gauge the dose.

It is not to be forgotten, however, that while single doses of 1 to 2 drams may be remarkably efficient in badly ruptured compensation, and even more so in auricular fibrillation, they may cause death in a case of partial heart block or may induce this state if superimposed on large doses recently given. In my opinion a very massive dose of digitalis should never be employed, except in auricular fibrillation, until by the electrocardiograph no contraindications to the use is discovered. I appreciate that this puts a limitation on the physician's field of endeavor, but it is unavoidable.

The official preparations of digitalis are the tincture (*Tinctura Digitalis*, U. S. and B. P.), dose 5 to 30 minims (0.3 2.0); and 1 to 3 drams (4.0–12.0) if it is desired to produce a powerful effect as soon as possible by a single dose.[1] The infusion (*Infusum Digitalis*, U. S. and B. P.), 1 to 4 drams (4.0–15.0); the fluidextract (no longer official), dose 1 to 4 minims (0.05–0.25); and the powdered digitalis leaves (*Digitalis Folia*, B. P.), dose ½ to 2 grains (0.03–0.12), generally given in a pill. It is generally considered that 2 grains of the leaves are equivalent to 20 minims of the tincture and that an ounce of the infusion equals 7 grains of the leaves. An infusion made by diluting a physiologically tested fluidextract has been proved by Bliss to be more nearly correct in strength than that made by the official method from the leaves.

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[1] Do not forget that the word minims means minims, not drops. (See Doses Part I.)

Some choice should be exercised in the use of the various preparations made from digitalis leaves, because the different active ingredients of the drug possess different solubilities and exert different effects on the circulation. Thus digitalin, digitoxin, and digitalein all act as powerful stimulants to the heart muscle. Digitalin also stimulates the vagus peripherally and centrically. All three of these raise arterial pressure by stimulating the vasomotor system peripherally and centrically. Digitonin, on the other hand, does not stimulate the heart muscle, but rather depresses it. It also depresses the vagus, and thereby somewhat antagonizes the digitalin,[1] digitoxin, and digitalein.

If we now turn to a consideration of the solubilities of these principles, we can readily explain the different effects produced by the infusion and tincture or fluidextract. Digitonin is soluble in water, as is digitalein; but digitalin is only slightly soluble and digitoxin is scarcely at all soluble in water. As a result, the use of the infusion in a case of heart disease would not give the patient the same degree of cardiac power as the use of the tincture, for not only would the most powerful stimulant of all to the heart, vasomotor system, and vagi—namely, digitalin—be present in small amount, but in addition the large proportion of digitonin would antidote it. On the other hand, digitonin is sparingly soluble in alcohol, while digitalin and digitalein are readily soluble in it, digitoxin being slightly so. It would seem, therefore, that in the presence of a failing heart and circulation the tincture and the fluidextract are the preparations greatly to be preferred to the infusion, because they contain large amounts of the active stimulant ingredients.

The reason that the infusion acts efficiently as a diuretic in some cases probably depends upon the fact that as it does not contain so much digitalin it is less apt to cause spasm of the renal vessels; but if the heart is feeble and there is renal stasis, the tincture is probably the better preparation to overcome this state, because it both aids the heart and by contracting the renal vessels overcomes the stasis. The infusion is far more apt to disorder the stomach than the fluidextract or tincture, because of the irritating digitonin. The dose of digitalin, which ought not to be used as a substitute for digitalis, is

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[1] By digitalin, reference is made to that prepared by Merck, and sometimes called the digitalin of Schmiedeberg, and not the amorphous form of Homolle nor the crystalline digitalin of Nativelle.

$\frac{1}{60}$ grain (0.001). There is, however, a great difference of opinion as to the correct dose. Some men give as much as 1 grain; but the French physicians state the dose of Nativelle's digitaline should be only $\frac{1}{600}$ to $\frac{1}{160}$ grain. This remarkable variation in the doses recommended indicates that very different kinds of digitalin are used or else that the small doses suggested are impotent, for it will be perceived that while one digitalin is given by some in dose of 1 grain, the digitalin of Nativelle is given in the dose $\frac{1}{600}$ of a grain.

Much confusion exists as to the names applied to the various derivatives of digitalis. There appear to be no less than four distinct substances upon the market called "digitalin," and they differ greatly in power. Thus, "German crystalline digitalin" is really digitonin, that is, a saponin. French crystalline digitalin is digitoxin and corresponds to Nativelle's digitalin. French amorphous digitalin purum is seemingly a mixture of digitalin and digitoxin and equals Homolle's digitalin. German amorphous digitalin purum is a mixture of true digitalin and digitalein with 50 per cent of amorphous digitonin. Digalen (dose of solution 1 to 2 cc.) is said by Kobert to be a solution of digitalein in water, but Cloetta thought it to be soluble digitoxin. Digipuratum, now called Digitan (dose $1\frac{1}{2}$ grains [0.1] or in liquid form 1 cc.), according to Grier is a mixture of digitoxin and digitalin, and is said to be of the same strength as the leaves, grain for grain. All these facts indicate pretty clearly that the physician should use none of these products, but rely on galenical preparations of digitalis leaves.

Under the name of Digifortis a very potent product which is 50 per cent stronger than the official tincture is now manufactured and can be relied on as it is tested physiologically.

Under the name of "Digitalone," Houghton has devised an excellent preparation of digitalis, now on the market, suitable for use by mouth or hypodermic needle, since it represents the full therapeutic value of the tincture, and is readily absorbed with little irritation when given hypodermically, which is not true of tincture of digitalis. This product is "fat-free," and is standardized by well-recognized pharmacological tests upon the lower animals.

Digitalone is put up in hypodermic tablets corresponding to about 8 minims of tincture of digitalis. It also appears in ampoules equal to 16 minims (1.0) of the tincture, and in 1-ounce bottles for use by the mouth. Its strength in its liquid form is that of the U. S. P. tincture.

Under the name "Digifoline," a Swiss chemical firm markets a preparation which is said to contain all the active ingredients of the leaf with all of its useful parts. It is physiologically standardized. It appears in tablets and in liquid form in ampoules, the contents of which represent $1\frac{1}{2}$ grains of digitalis leaf. The ampoules are intended for hypodermic therapy. It is somewhat irritating.

When digitalis cannot be given by the mouth there is little use in giving any of the official preparations hypodermically, for they are precipitated in the tissues; and physicians, according to their fancy, employ one of the products named above. Unfortunately they are all more or less irritating. Absorption of digitalis may be brought about by the use of a poultice made by placing some digitalis leaves in a small bag and steeping them in hot water. The bag is then placed over the loins. This plan of treatment must be cautiously employed to avoid poisoning, because one cannot tell how much digitalis is being absorbed.

Attention has already been called to the necessity of using a preparation which has been subjected to a physiological test by the manufacturer before it is placed on the market. This is important because the crude drug varies so greatly in strength that even the most careful pharmacist cannot be sure that each lot of leaves is of equal medicinal strength, and chemical analysis of their complex make-up is practically impossible. Often when a patient has been taking an ordinary preparation of digitalis without good results the writer has seen the use of a physiologically tested and active preparation do much good.

All the galenical preparations of digitalis deteriorate with the passage of time and this is particularly true of the so-called "special preparations" which should always bear on the label the date of the manufacture.

DIONIN.

Dionin, or *Æthylmorphinæ Hydrochloridum,* U. S., is an artificial product derived from morphine, and occurs as a white crystalline, faintly bitter powder. It is soluble in about 8 parts of water, 20 of alcohol, and slightly soluble in ether and chloroform.

Dionin is used for several purposes in medicine, both internally and externally. Internally it is employed in the dose of ¼ or ¾ grain (0.015-0.045) to relieve *excessive cough* and *pain in the chest,* in various forms of pulmonary disease. It has also been used as a substitute for morphine in various painful affections of the internal viscera, as in *ulcer* and *cancer of the stomach* and *bowel,* in cases in which morphine cannot be used because of nausea. It is said to be equally efficient with morphine in the relief of pain but less powerful for the purpose of producing sleep. It may also be given to fortify barbital and sulphonal in cases of *insomnia.* In the dose of 1 grain (0.06) dionin may be used in suppository in *painful conditions of the rectum.*

Externally dionin finds its chief use in the eye. It has been found especially valuable in certain types of *ulcerative* and *parenchymatous keratitis, iridocyclitis,* and *glaucoma* when used in solutions varying from 1 to 5 per cent. This solution is dropped into the conjunctival sac two or three times a day. At first it causes a sharp reaction with a sense of burning and marked edema of the conjunctiva, which, however, subsides in about twenty minutes, and analgesia, not anesthesia, develops. That is, it relieves pain, but does not locally anesthetize, as does cocaine. When it is used mixed with cocaine, both an anesthetic and analgesic effect is obtained. Immunity to its irritant effects is so soon established that its use on subsequent days causes little or no irritation.

Patients who have arteriosclerotic changes, or nephritis, sometimes suffer to an extreme degree from the disagreeable effects just described not only as to severity, but for a number of days.

If the patient is hypersensitive, the primary painfulness of dionin may be prevented by preceding its use by cocaine solution. It is also advisable to drop the dionin solutions into the conjunctival sac so as to avoid the cornea, which is much more sensitive to its effects than the conjunctiva. Dionin may be added to solutions of myotics or mydriatics when it is desired to relieve eye pain at the same time that the beneficial effects of the other drug are obtained.

DIURETIN.

(See Sodio-salicylate of Theobromine.)

DUBOISINE.

Duboisine is the alkaloid of the leaves of *Duboisia myoporoides*, a plant of Australia. The crude drug is little used in medicine, but duboisine sulphate is used as a mydriatic under the same conditions as is atropine, and more largely still as a hypnotic in *insanity*, interchangeably with hyoscine. The dose of duboisine sulphate hypodermically as a hypnotic is $\frac{1}{80}$ to $\frac{1}{60}$ grain (0.0008–0.001). The clinical experience so far adduced would seem to indicate that it tends to decrease urinary secretion and to disorder the digestion, producing at the same time a soapy taste in the mouth, with excessive dryness of the mucous membranes. Rarely it causes profuse salivation or sweating in those who have an idiosyncrasy to its use. In a large number of insane and hysterical cases de Montyel found its use was followed by vomiting of part of the food, but the patients seemed to have no nausea. The sulphate has been used with much asserted success in the treatment of *paralysis agitans*. Usually the dose by the mouth for this purpose has been $\frac{1}{100}$ grain three times a day. Cividati and Gianelli assert that duboisine is useful in *epilepsy*, particularly in its psychic forms.

ELATERIUM.

Elaterium, B. P., is a sediment obtained from the juice of squirting cucumber. Elaterium is not official in the U. S. P., but its active principle, elaterin (*Elaterinum*, U. S.), is official. Elaterin is a neutral principle deposited by the juice. Notwithstanding this fact, the crude drug is largely used.

Physiological Action.—Elaterium is a decided irritant to all mucous membranes, and even to the fingers of those who handle it. Its chief effect when taken internally by man is to cause profuse water stools, but for some unknown reason it rarely acts upon animals in this manner.

Therapeutics.—This drug is the best hydragogue purge which we have, causing large watery passages, but not producing much pain when used in proper dose. For this reason it is useful in the treatment of *local serous transudations*. In serous effusions due to acute or chronic inflammatory processes it is of little value because in such cases the stomata of the serous membranes involved are closed by fibrin, as in *pericarditis* and *pleurisy*. In *dropsy* and *ascites* or general anasarca it may be useful. It ought never to be used in cases of marked exhaustion, and may be advantageously followed, soon after it acts, by alcoholic stimulants. In *uremia* with dropsy it is thought to aid in the elimination of the uremic poison by the bowel. In *cerebral congestions* or *effusions* the drug is of service by depleting the diseased vessels.

In poisoning by elaterium the symptoms are those of violent gastro-enteritis, and must be treated accordingly. (See Gastro-enteritis.)

Administration.—The dose of elaterium is $\frac{1}{6}$ grain (0.01), given in freshly made pill. Elaterin is best given in the dose of from $\frac{1}{20}$ to $\frac{1}{10}$ grain (0.003–0.006), as follows:

℞—Elaterini	gr. iv (0.25)
Alcoholis	f℥iv (120.0).—M.

Dissolve by gentle heat.
S.—Half a dram contains $\frac{1}{16}$ grain (0.004), or one full dose.

Pulvis Elaterini Compositus, B. P. (elaterin 1, sugar of milk 39), is given in the dose of 1 to 5 grains (0.06–0.3).

EPHEDRIN.

Ephedrin hydrochloride, or sulphate, are the salts made from the active principle of Ma Huang, a Chinese plant. Solutions can be sterilized by boiling. It has a physiological action almost identical with adrenalin, except that it may act primarily as a cardiac depressant. Given hypodermically, or intramuscularly, it raises blood-pressure for a period of five hours. (Chen.) Applied locally to a mucous membrane it causes great shrinking of the tissues so that they appear white or constricted. This constriction lasts about two hours and is not followed by the secondary engorgement characteristic of the later effects of adrenalin. When used locally the strength is 2 to 3 per cent in water on a cotton applicator, or by spray. When used by the stomach it should be given on an empty stomach with hot water. When used to act as a circulatory stimulant the dose by needle is ½ grain for an adult. A slightly larger dose, 1 to 1½ grains (0.06 0.09) is given when used by the mouth. It is not destroyed in the stomach as is adrenalin. These doses are also used for the relief of *asthma* and *hay fever*, but it is not as efficient in the relief of asthma as is adrenalin. It may be necessary to repeat the dose in severe cases every hour until the results desired are obtained, but until individual susceptibility is determined, the first hypodermic dose should not exceed ½ grain, and it is contraindicated if there is cardiac feebleness. Indeed it may induce acute cardiac depression. A few drops of a 1 to 3 per cent solution when dropped in the eye dilates the pupil in about fifteen to thirty minutes. The drug does not paralyze accommodation and its mydriatic effect persists about one-half to one hour. It can, therefore, be used as a substitute for homatropine. Unlike adrenalin it does not blanch the conjunctiva but does do so if combined with procaine.

The fact that ephedrin may act, particularly if the dose is large, as a cardiovascular depressant should make the physician very cautious as to its use in acute conditions of circulatory failure. Indeed, it is questionable if it ever should to be employed for the purpose of combating acute circulatory failure. When given in overdose, or to very susceptible persons, it may cause sweating, tremor, palpitation of the heart, weakness, nausea and occasionally vomiting.

ERGOSTEROL.

(SEE UNDER VITAMINES).

ERGOT.

Ergota, U. S. and B. P., is derived from the spawn or mycelium of the fungus known as *Claviceps purpurea*, which grows in the flower and replaces the grain in common rye, or *Secale cereale*. After being kept for a year crude ergot is not fit for use.

Many so-called active principles of ergot have been isolated by chemists, and named ecbolic acid, ergotic acid, sclerotinic acid, and ergotin. None of these represent the entire drug. One active constituent is ergotoxin, which is an amorphous alkaloid and is probably the chief agent in the effect of ergot on the uterus and bloodvessels, although ergotamine is also present and has a similar effect. Another ingredient is tyramine, which raises blood-pressure by a tonic effect on the bloodvessels. It is present in too small an amount to be effective. Histamine is also present, and this ingredient, although an active uterine stimulant, lowers blood-pressure markedly. Like tyramine, it is present in minute amounts.

Physiological Action.—NERVOUS SYSTEM.—Upon the nervous system ergot exercises little, if any, effect.

CIRCULATION.—Ergot, when injected into the circulation causes a primary fall of arterial pressure, followed by a slight rise. This rise is probably due to a stimulation of the muscular coats of the bloodvessels, but the primary fall is caused by its direct depressant effect upon the heart muscle, resulting from the direct contact of the drug *en masse* with the heart. If the dose be very large, and the fall of pressure is not recovered from, progressive paralysis of the vasomotor apparatus and heart occurs. When given in medicinal doses by the stomach the drug causes a slight rise of arterial pressure, chiefly by an action on the heart and the muscular coats of the bloodvessels, but this effect would seem to be too feeble to be of much value in bedside practice.

Uterus and Unstriped Muscular Fiber.—It has been commonly taught that the contractions of the uterus produced by medicinal doses of ergot are due to the stimulating influence of this drug upon the muscular fibers of this organ; but Dale seems to have proved that the influence is exercised on the nerve-endings in the muscles. Hemmeter asserts that the drug causes uterine contractions by stimulating the centers in the lumbar portion of the spinal cord which controls this viscus, but this has been denied.

On the uterus ergot in full medicinal dose exerts its influence not by increasing the normal pains of labor, but by causing a tetanic, tonic, unyielding uterine spasm which drives all before it. In very small doses it may assist the normal contractions without causing them to become tetanic.

Ergot acts as a stimulant to all unstriped muscular fibers.

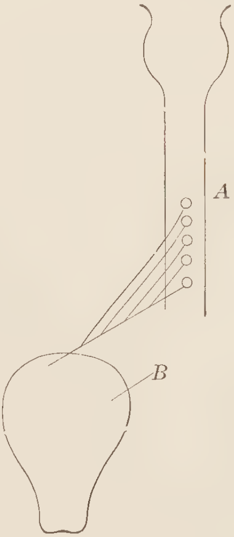

Fig. 44.—*A*, ergot stimulates the uterine centers in the spinal cord, and *B*, the muscular fibers in the uterus itself.

Acute Poisoning.—The symptoms of overdosing from ergot, when the effects are slowly produced, are sometimes great hunger or craving of food, at other times nausea and vomiting. If the poisoning is quite severe, there are great restlessness, headache, delirium, and coldness of the surface of the body.

Chronic Poisoning.—Two forms of poison from the prolonged use of ergotized rye bread sometimes occur. One is characterized by spasmodic muscular contractions, the other consists in the formation of gangrenous sloughs. In the first of these forms it is not very uncommon for cataract to develop, and it is stated that the spasms are due to the influence of one of the principles of ergot—namely, cornutine.

Therapeutics.—Ergot is given to parturient women for the prevention or arrest of *postpartum hemorrhages*. For the prevention it should be given to the woman by the mouth after the delivery of the head, but in many instances its use is needless. When administered to check a hemorrhage already flowing, the doses should be large, as much as 1 to 2 drams (4.0–8.0) of the fluidextract. The drug should produce its effects in about fifteen minutes, and may be repeated every fifteen minutes until it acts. The action lasts about one-half hour. Ergot should not be given in the early stages of labor, but this rule may, under certain conditions, be modified. If uterine inertia comes on in the course of a normal labor, which cannot be overcome by the use of coffee or strychnine, or other nerve stimulant, a *small* dose of ergot may be employed. Such a small dose does not cause a constant tetanic uterine contraction, but simply brings on the "to-and-fro" movements. By a "small dose" the writer means from 5 to 20 minims (0.3–1.3) of the fluidextract. Caution must be used even with this dose.

If the birth-canal is obstructed, ergot should never be employed, and, unless the os uteri is well dilated, it should not be given in any dose. These facts are emphasized when it is recalled that the uterus in its maximum contractions produces a pressure of about 5 pounds to the square inch.

In postpartum hemorrhage it is well to give "Ergot Aseptic" or "Ergone" hypodermically. "Ergot Aseptic" is dispensed in sealed and sterile glass ampoules, and is a concentrated preparation of ergot intended for hypodermic use. Each bulb holds one dose, and the drug is drawn directly from it into the syringe. This is a most useful preparation, physiologically tested and twice as strong as the fluidextract, U. S. P.

When ergot is given, care should be taken that the uterine cavity is free from all clots or placental fragments, lest closure of the os uteri under the influence of the drug imprison these harmful materials.

According to many obstetricians, whose results have been confirmed by a number of special studies, ergot in moderate doses very distinctly aids in overcoming *subinvolution of the uterus.*

In *hemorrhages from the lungs* and *kidneys* or other unapproachable parts ergot is thought by some to be very useful when given by the mouth, but it is probable that it rarely achieves any good. Particularly is this the case in pulmonary hemorrhage, since a vasomotor system practically does not exist in the pulmonary vessels, and the increased pressure caused by the ergot in the general systemic circulation may increase the pulmonary leakage. The truth is, that in pulmonary hemorrhage little real good can be obtained by the use of vasoconstrictors.

In *menorrhagia* and *metrorrhagia*, and in some cases of *night-sweats*, ergot is of service. In *hypostatic, pulmonary*, and other *congestions* it is useful, particularly if used with digitalis. In *dysenteries* with bloody stools and in *serous diarrhea* ergot sometimes does good.

Some persons suffer from *vertigo* associated with hyperesthesia of the scalp and *headache.* Relief can often be obtained in such cases by the use of 20 minims (1.3) of the fluidextract of ergot and 5 to 10 grains (0.3–0.6) of bromide of sodium three times a day.

Ergot has been used very largely in the treatment of *uterine fibroids* as an expulsive remedy and cure. It is only of value in those cases where the growths are just beneath the mucous membrane. By the contractions of the uterine muscular fibers the blood supply of the growth is decreased, the recurring hemorrhages cease, and the tumor is finally expelled, having sloughed out of its bed. This method is far inferior to the knife, and very painful and prolonged. Large growths cannot be so treated and if any means is to be resorted, save operation, radium is generally employed. Ergot is sometimes useful in the treatment of *bleeding hemorrhoids*, and in *diabetes insipidus*, in which disease it is well to combine with it the bromide of sodium.

Administration.—Ergot is official as the fluidextract (*Fluidextractum Ergotæ*, U. S.; *Extractum Ergotæ Liquidum*, B. P.), dose ½ to 1 dram (2.0–4.0), 10 to 30 minims (0.6–2.0), B. P.; and the extract (*Extractum Ergotæ*, B. P.), dose 5 to 30 grains (0.3–2.0), 2 to 8 grains (0.12–0.48), B. P. Bonjean's ergotin is made by a special process, and it can be given hypodermically if "Ergot Aseptic" or "Ergone" cannot be had. The B. P. preparations are *Infusion Ergotæ*, 1 to 2 fluidounces (30.0–60.0), and *Injectio Ergotæ Hypodermica*, B. P., given in the dose of 3 to 10 minims (0.2–0.6) by subcutaneous injection. The B. P. also recognizes an ammoniated tincture of ergot (*Tinctura Ergotæ Ammoniata*). Ergotin (*Ergotinum*) is given in the dose of 2 to 5 grains (0.12–0.3).

As ergot is a drug that varies greatly in physiological activity in its crude state, and cannot be chemically assayed with advantage, the physician should always use a preparation which has been physiologically tested by the manufacturer before it is placed on the market. This may be done by studying its effect on the uterus of a pregnant animal, or by giving it to animals and observing its effect on the caliber of the small vessels. If the drug is active, it causes stimulation of the muscular coats of the vessels; and if its use is persisted in, it finally occludes them. Houghton has shown that an active ergot will cause gangrene of the rooster's comb if it is given constantly. Inert ergot will not do this. Much credit is due to Houghton for having perfected this valuable pharmacological test.

The younger Wood asserts that the fluidextract loses 10 per cent a month in strength even when it is kept hermetically sealed in a bottle. A fresh preparation is therefore essential.

The active principle tyramine may be given as an active vascular stimulant in the dose of $\frac{1}{10}$ grain (0.006) hypodermically. It has usually failed in my hands.

ERYTHROL TETRANITRATE.

(See article on NITROGLYCERIN.)

ESTROGEN.

(SEE OVARIAN EXTRACT).

ETHER.[1]

Sulphuric ether is official as *Æther*, U. S., and *Æther Purificatus*, B. P., and in the U. S. Pharmacopœia of 1880 was called *Æther Fortior.* It is a liquid composed of 96 per cent, by weight, of absolute ether or ethyl oxide, and 2 to 4 per cent of alcohol containing a little water. It is not an advantage to use absolute ether particularly at high attitudes because it evaporates too quickly. This so-called "dry ether," that is free from alcohol, while satisfactory at coast level is not so when at high areas. It should be kept in partly filled, well-stoppered containers, preferably tin cans, in a cool place, far from lights or fire. It is a transparent liquid having a peculiar odor. Ether boils at about 35° C. (96° F.), and it should, therefore, boil when a test-tube, containing some broken glass and half filled with it, is held for some time closely grasped in the hand.

Ether is made by the action of sulphuric acid on ethylic alcohol.

It is highly volatile and inflammable. Its vapor, when mixed with air and ignited, explodes violently. The color of light blue litmus paper moistened with water should not be changed to red when the paper is immersed in ether for ten minutes. Upon evaporation, ether should leave *no residue.* If 10 cc. of it be poured, in portions, upon clean odorless blotting paper, and allowed to evaporate spontaneously, *no foreign odor* should be perceptible when the last trace of ether leaves the paper.

Ordinary ether is not used as an anesthetic, but for the abstraction of oils and for other pharmaceutical purposes. It contains about 74 per cent of ethyl oxide and 16 per cent of alcohol, with a little water.

Owing to its inflammable nature ether should never be held near a fire or light, and, as its vapor is heavier than air, any flame in the room should be above the patient, not below him. No flame should be held nearer to the ether than 5 feet. When ether is given with oxygen its explosive qualities are greatly increased and great care must be taken to avoid electric sparks and in the use of a cautery.

Physiological Action.—The action of ether on the animal organism when its vapor is inhaled is very rapid and powerful, but fleeting. When applied to the skin it causes intense cold if allowed to rapidly evaporate, and may be used in the form of a spray to benumb sensation.

The passage of ether vapor into the blood by way of the lungs depends upon the law governing the partial tension of gases. If the air in the alveoli of the lungs contains a given per cent by volume of ether, there will be a tendency for the blood in the bloodvessels of those alveoli to take up this vapor until the percentage is the same in the blood as it is in the air of the alveoli. If, on the other hand, the blood contains more ether vapor than the air, the vapor will tend to pass from the bloodvessels to the alveoli. This explains why it is that in accidents during ether anesthesia artificial respiration, by forcing out the ether-laden air of the alveoli, aids the blood in getting rid of poisonous amounts of the drug and so directly tends to restore the patient.

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[1] The student should read the article on Chloroform in conjunction with this article.

Upon mucous membranes ether as a liquid or in vapor acts as an irritant, and causes, when its concentrated vapor is first inhaled, great irritation of the fauces and respiratory tract, so that temporary arrest of respiration is not uncommon. The face becomes suffused and red and the conjunctiva injected. Owing to these conditions the patient often is restless or struggles to move his face away from the vapor, but a stage of quiet soon succeeds this primary stage of struggling. During this period of quiet the breathing is generally full and deep and the pulse rapid but strong, while the ocular reflexes are at its beginning intact. Following this stage a second period of restlessness or struggling may come on, in which the patient becomes absolutely uncontrollable except by brute force. Yelling, shouting, cursing, or laughing and crying, may be prominent symptoms, and the individual is pugilistic, caressing, or ill-tempered, according to his temperament. All these disagreeable symptoms can usually be avoided if the drug is gently and skilfully given. If the drug is now pushed a condition of total unconsciousness and anesthesia is

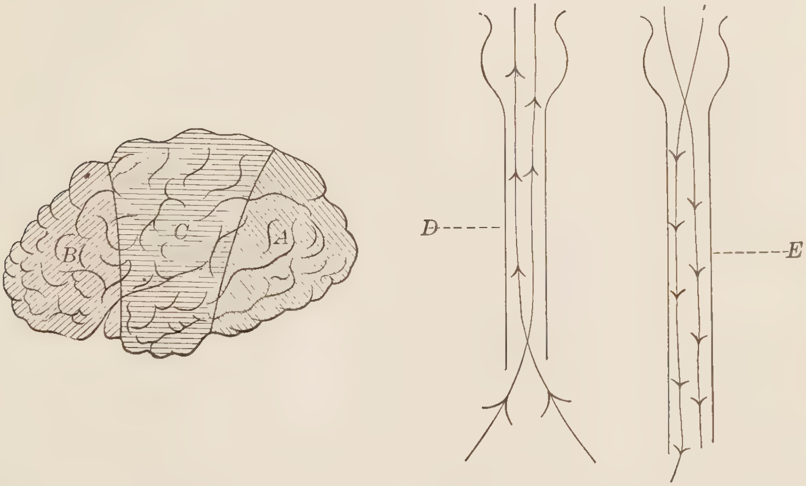

Fig. 45.—Ether produces anesthesia by depressing the perceptive areas in the brain, *A*. Later it depresses the intellectual areas, *B*, and the motor areas, *C*. After this the sensory paths in the spinal cord are depressed, *D*, and finally the motor tracts in the cord, *E*.

soon attained, and quietude takes the place of the struggles. This is the time for the operation to be carried on, for if it is attempted in the earlier stages the struggles of the second stage prevent any operative procedures. (See Therapeutics, below.) It is not proper to push the drug until the muscular relaxation amounts to complete flaccidity, as this endangers the respiration. The color of the lobe of the ear gives useful information. If it is dusky and cyanotic less ether or more oxygen is needed. If unduly pallid it indicates a failing circulation.

Nervous System.—In producing its effects, ether acts first on the brain, then on the sensory tracts of the spinal cord, then on the motor tracts, then on the sensory side of the medulla oblongata, and finally upon the motor side of the medulla, and thereby produces death from respiratory failure if given to excess. Upon the nerve trunks it exerts no effect unless it is directly applied to them. Ether does not produce anesthesia by influencing the blood, coagulating the protoplasm of the nervous system, or by any other destructive influence. It simply inhibits, for the time being, the vital functions of the parts affected by it, probably as a result of the special affinity of the lipoid contents of the brain cells for the drug. The anesthesia from ether develops when ether vapor is present in the blood serum in the proportion of 1 to 400. (See Chloroform.)

Circulation.—Ether is one of the most diffusible and rapidly acting cardiac stimulants which we possess, and is correspondingly fleeting in its effects. It increases the pulse-rate and force by stimulating the heart and the arterial pressure by increasing the activity of the vasomotor centers. This statement has been contradicted by laboratory investigators, who claim that ether is never a cardiac stimulant in a strict technical sense. However this may be, ether is used and acts as a most useful circulatory stimulant in man when it is given by the mouth and when inhaled in small amounts. In overdoses it acts as a cardiac depressant, but only when the amount is very large. Upon the blood, the author's colleague, J. Chalmers Da Costa, has shown that ether, when given by inhalation, decreases the hemoglobin richness of each corpuscle, although there is an apparent increase in the number of the corpuscles themselves, particularly in those persons who are already somewhat anemic.

Respiration.—As already stated, when ether is first inhaled in concentrated form it often causes arrest of respiration. According to Kretzschmar, this is due to an irritation of the trifacial nerve, which causes a reflex spasm of the glottis, and not to irritation of the peripheral vagi in the lungs. This is only partly true, for the author has proved that section of the vagus nerves prevents this occurrence, so that both the vagal and trigeminal irritations are responsible for the arrest.

In patients under ether the movement of the diaphragm is an exceedingly interesting study, for before the condition known as surgical anesthesia is developed, while there is still some rigidity and the throat reflex is not completely abolished, the contractions of the diaphragm are frequently so violent that unless the laryngeal opening be absolutely free the intercostal spaces are depressed and the abdominal contents thrust violently downward and outward. Just so soon, however, as the chin is pulled forward and a free access of air is allowed, the abdominal displacement, though it is still present, is not so great, and the chest movement is no longer reversed. As the ether is pushed the respiration becomes purely thoracic, the diaphragm no longer taking part in the respiratory cycle, or becoming so relaxed that it allows the chest on expansion to aspirate the abdominal viscera upward, as is shown by the retraction of the belly-walls at a time when they should normally expand with the thorax in inspiration. This observation would seem to point to the fact that the primary stimulant action of ether upon the respiratory apparatus is particularly felt by those centers which govern the movements of the diaphragm, and that, as this is the case, these centers later are the first to feel the paralyzing effect of still larger amounts of the drug.

These facts give us, therefore, a danger signal during the administration of ether, and the integrity of the diaphragmatic function, as represented by the movement of the belly walls, should be as carefully observed as are the thoracic excursions, the character of the pulse, or the condition of the pupil. The rule may therefore be laid down that when the diaphragm ceases to act, anesthesia has been carried to its extreme legitimate limit, and that the use of an anesthetic after this time must be carried on with the greatest care and watchfulness.

The diaphragm is the first part of the respiratory mechanism to yield to respiratory paralysis. In death from any cause the progress of failure of respiration will, in the vast majority of cases, be denoted by a failure on the part of the diaphragm primarily, with compensatory excursions of the chest; and it is also to be noted that as the chest movements fail the accessory muscles of the neck come into play. These muscles in time cease to act, the hyoidean group lose their *point d'appui*, the chest remains motionless, the lower jaw is dropped, and the scene is closed by a few gasps in which the muscles of the neck may be the chief factors.

Upon the respiratory center ether acts as a powerful stimulant when used in ordinary amounts; in overdose it paralyzes this part of the nervous system.

TEMPERATURE.—Prolonged etherization lowers the bodily heat very greatly. That of the dog may be lowered some 9° F. in an hour if the drug be pushed, and as great a fall has been known as 4° F. in man. The fall is partly due to the depression of the nervous system and the chilling of the body and lungs by the evaporation of the drug.

Elimination.—Ether escapes from the body by the lungs and kidneys, chiefly by the lungs.

Untoward Effects.—Ether, while safer than chloroform, is not absolutely devoid of dangerous effects.[1] Sometimes, when the drug is pushed too strongly, deep cyanosis with pulsation of the jugular veins shows deficient oxygenation of the blood and cardiac distention. The ether should be withdrawn at once and oxygen freely given. The onset of clonic muscular movements and rigidity may be an evidence of lack of oxygen rather than of too little ether. In other instances there is no venous distention but the patient is suffering from general circulatory failure as shown by a gray or leaden color. This a very grave symptom to be combated by oxygen and carbonic acid gas inhalation as the latter stimulates the respiratory and vasomotor centers. In other, very rare, instances sudden cardiac

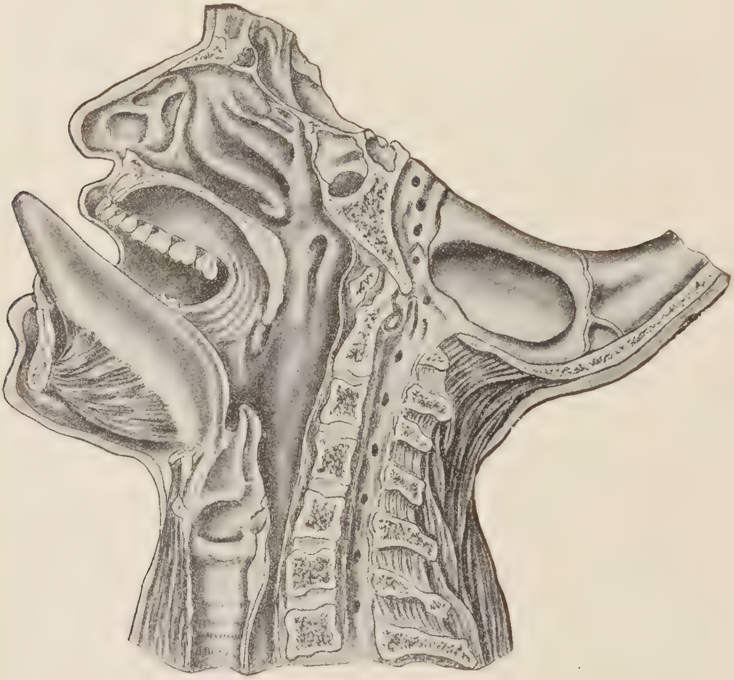

Fig. 46.—Illustrating how traction on the tip of the tongue draws the epiglottis away from the glottic opening and permits free ingress of air. Also showing how letting the tongue fall back in the mouth in anesthesia would close the air passages and permit the epiglottis to interfere with breathing. (This is important.) For a full description see article on Asphyxia. (From a research by Martin and the author.)

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[1] The mortality due to etherization is about 1 in 20,000; or, according to the combined statistics of Julliard and Ormsby, in 407,553 cases there were 25 deaths, or 1 in 16,302. (Compare Chloroform.)

failure has occurred or total arrest of respiration ensued. In nearly all cases of sudden death from ether grave kidney or heart lesions have been found at the autopsy. Rarely the rise of arterial pressure which it produces has caused apoplexy. This rise of blood-pressure can usually be avoided by the conjoint use of oxygen (see Oxygen) or the preliminary use of morphine to prevent nervous excitement.

The further treatment of accidents during etherization consists in the withdrawal of the ether, the use of artificial respiration to pump the ether out of the lungs and the employment of hypodermic injections of strychnine, atropine, and adrenalin, or more rarely, an intravenous injection of pituitrin, better than the others in a pressing emergency because it is more rapid in its action. Ether is often given hypodermically under such circumstances, and may occasionally do good; but its use is a bad practice for if the heart or respiration is already depressed by ether, the employment of still more of the drug simply makes matters worse. The cases in which such a line of treatment is followed by good results are those in which the failure of respiration is not due to a saturation of the body with ether, but to asphyxia produced by mechanical interference with free breathing, as, for example, the presence of mucus in the air-passages or a too close application of the inhaler to the face. In such cases the hypodermic injection of ether causes so much local pain and irritation as reflexly to excite respiratory movements, as well as to stimulate directly the respiratory center to greater effort.[1] Alcohol should not to be used if the other drugs named can be obtained, because alcohol is so nearly allied physiologically and chemically to ether. Friction, hot applications, and artificial respiration should be practised. (See article on Asphyxia.)

The diaphragm being the most important muscle of respiration, the physician should seek to stimulate it by resorting to Laborde's rhythmic traction of the tongue, which consists in rhythmically drawing the organ outward and upward from the mouth ten to fourteen times a minute.

As ether is at hand, it may be dashed on the chest and abdomen, to cause inspiration by reflex action, in lieu of cold water, which wets the clothes and does not evaporate rapidly.

In about 30 to 40 per cent of cases nausea and vomiting follow the use of ether alone. This can generally be prevented by the avoidance of food for twelve hours before an operation, and by the administration of cracked ice and small doses of acetanilid and brandy after the operation. (See Vomiting.) This condition may also be avoided in many cases by giving oxygen gas with the anesthetic or by inducing anesthesia rapidly by means of nitrous oxide and following it with ether. (See Oxygen, Important.) Clinical experience has also proved that the use of moderate doses of sodium bicarbonate for some hours before the use of the anesthetic prevents vomiting. Austin and others have shown that the use of ether increases the hydrogen-ion concentration in the blood for a brief period and decreases the sodium content for some hours, which perhaps explains this use of the sodium in practice. Severe bronchitis may occur in invalids and children after the inhalation of ether, and in many cases this is due more to exposure than to the drug. Pulmonary complications, while possibly due to the direct effect of the ether, are probably chiefly the result of the inspiration of particles of food, foul secretions from the mouth, and perhaps blood, into the lungs, the glottis being anesthetized and unable to protect the lungs from the invasion of foreign matter. Great cleanliness of the mouth is essential before every operation, and care should be taken during and after an operation that septic materials are not inspirated. It is wise to order a peroxide of hydrogen mouth-wash beforehand.

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[1] As consciousness is not necessary to the carrying out of a reflex action, this is perfectly possible and probable.

Total or partial anuria may develop after etherization, particularly after abdominal operations. This is a very dangerous symptom, which can sometimes be removed by giving nitroglycerin, to relax spasm of the renal vessels, and a large rectal injection of normal saline solution. It has, however, been proved, both experimentally and clinically, that ether is not capable, in the ordinary patient, of producing renal disorder of any moment unless the kidneys are already diseased or the patient is soaked with the drug, as sometimes occurs when it is improperly given. Weil asserts that ether is not dangerous even in those with moderately diseased kidneys but in a goodly proportion of cases the use of ether diminishes urinary flow and decreases the escape of solids even more than it decreases the elimination of liquids. The employment of ether in diabetic patients is dangerous; the patient often never regains consciousness after its use. Postanesthetic toxemia may arise after the use of ether. Cases have been reported by Brachett, Stone, Low and others. (See Chloroform for Postanesthetic Toxemia.)

Sometimes after the use of ether in the case of an old person or a child the bronchial tubes so fill with mucus that there is danger of the patient drowning in his own secretions. A full dose of atropine, which checks secretion, given hypodermically, is useful at such times, and may be used beforehand as a prophylactic.

Sometimes after an anesthetic is given the patient is found to have a monoplegia. This is not due to the anesthetic, but to pressure exercised upon the nerve supplying the part during the anesthesia. It is a true pressure-palsy.[1]

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[1] Miller in an analysis of 5000 anesthesias obtained the following interesting results, nitrous oxide being used in 1493 and ether in 3501, but gas was nearly always used as a preliminary to ether. Circulatory complications developed oftener after gas oxygen than after ether, 1.53 per cent complications, mortality 0.8 per cent as against 1.06 per cent and 0.3 per cent. Cerebral embolism and hemorrhage occurred seven times as often after gas oxygen as after ether. Pulmonary embolism occurred oftener after gas-oxygen than after ether (50 per cent). Eighty per cent escaped postanesthesia nausea and vomiting after gas-oxygen and only 50 per cent escaped after ether alone.

Administration.—Before ether is used the physician, if time permits, should study the patient as to his circulation and kidneys and as to his general condition. Rest in bed and mild digitalization is wise if he is weak. Carbohydrates should be given. In giving an anesthetic it is of the greatest importance that the patient shall not be frightened or made nervous by its too free use at first, and it is better in nervous women and children to produce anesthesia while they still remain in bed, so that the sight of the operating-room will not disturb them. By this means not only nervous strain is avoided, but fearful "nightmares" while under the effects of the drug are prevented. The greatest gentleness should be exercised and the mind diverted, if possible, by some pleasant thoughts. A few drops of oil of bitter orange placed on the inhaler during induction of anesthesia and after the ether is stopped prevents nausea and vomiting.

In all persons it is a mistake to have the shoulders and head resting on the same plane as the body, particularly in adults and in the obese. This flatness is constantly practised. Let him who doubts its disadvantage attempt to lie on a flat hard surface without a pillow and he will be conscious of difficulty in respiration.

Ether is used chiefly as an anesthetic by means of inhalation.

One plan of administration is by the so-called "drop method." This consists in using an Esmarch inhaler (see Chloroform), and allowing the ether to fall drop by drop upon its surface in the same manner that chloroform is used, but somewhat more freely. By this means the patient escapes disagreeable oppressive sensations at the beginning of the administration and, more important, the nausea and vomiting during and after anesthesia are greatly diminished as to frequency of occurrence and severity, as is also the danger of renal and respiratory irritation and postanesthetic toxemia. In other words, the patient is not in danger of being poisoned by an excess of the drug, but is kept under its effects only sufficiently to avoid pain, restlessness, and voluntary movement. The disadvantages of this plan are that it takes longer to anesthetize the patient, uses more ether, and is often not adequate in those addicted to narcotics or for powerful men. It is, however, peculiarly suitable to women and children. The use of an "Allis inhaler" (Fig. 47) enables us to use the "drop method" in the more resistant patients because larger amounts of ether can be given and yet the patient receives plenty of air. There is no justification in giving the ether so freely as to cause a sense of suffocation and fear. The better way is to hold the inhaler at some distance from the face, and gradually bring it nearer as the effects of the ether are developed. As the vapor of ether is heavier than air, it falls over the patient's face in concentrated form, even if the distance between the inhaler and the patient amount to several inches. It is improper therefore to apply the inhaler to the face at the very beginning of the inhalation. After partial anesthesia is attained, the inhaler should be placed closely over the face and the vapor be pushed in a more concentrated form for a brief period. Care should be taken that the ether does not get into the eyes of the patient, either in vapor or liquid form, owing to the irritation which it will set up. To prevent this a piece of thin muslin wet with water will be found of service if placed over the eyes.

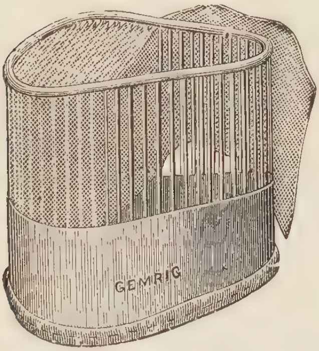

Fig. 47.—Allis inhaler.

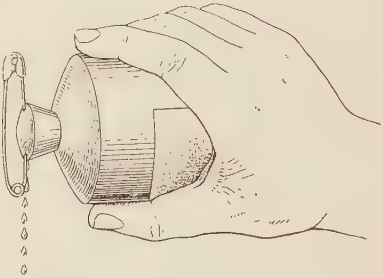

Fig. 48.—Safety-pin to make ether-dropper out of ordinary can.

Much of the irritation of the upper respiratory passages produced by ether may be avoided by wetting the inhaler with 1 or 2 drams (4.0 8.0) of an alcoholic solution of menthol (2 per cent) or by a few drops of oil of orange. This also serves to relieve postanesthetic nausea.

When ether is to be given no solid food ought to be allowed the patient for twelve hours preceding its use, in order to avoid vomiting during and after the operation, but easily assimilated liquid carbohydrates, such as barley or rice gruel, may be given later than this with advantage. (See Chloroform.)

The patient should not be allowed to retain any foreign body or artificial teeth in the mouth, as they may slip into the larynx and cause death while the anesthetic is being given.

When a general anesthetic is used to prevent suffering, it should be remembered that, although it prevents the intellectual centers from appreciating pain by blotting out consciousness, and so puts aside psychic shock, it does not prevent painful impulses from reaching the spinal cord and medulla oblongata, the latter being a most vital spot. In delicate persons or in severe operations it is often advisable to block these impulses by injecting procaine into or around the tributary nerve, thereby protecting the central nervous system.

At the present time ether is comparatively rarely given as an initial anesthetic, being preceded by nitrous oxide and oxygen, so that the former gas puts the patient under and thereby the uncomfortable early stages of etherization are avoided. Less ether is necessary and time is saved. Again the patient, having taken less ether, rarely suffers from the nausea and depression induced by straight ether anesthesia. In some instances the ether is given by the alternately drop method with the gas and oxygen. It has been shown statistically that this combined method gives a lower operative and postoperative morbidity. In many cases also it is advantageous to precede the anesthetic by one-half hour or less by morphine and atropine hypodermically, particularly if the patient is apprehensive and nervous. Stèhle and Bourne have recently shown that whereas morphine and ether when used alone tend to decrease renal activity, their simultaneous use actually increases kidney function. As little noise and confusion as possible should be permitted after the injection and during the subsequent inhalation. (See Nitrous Oxide.)

In hospitals, when the services of a well-trained anesthetist can be had it is a common practice to use an apparatus which consists of a tank of oxygen, one of nitrous oxide and sometimes a third tank containing oxygen and 5 per cent of carbon dioxide. (See Carbon Dioxide and Figure under Ethylene). They are connected by valves and tubing to an inhaler which fits over the patient's face and the gas is allowed to bubble through the ether, the vapor then going to the inhaler. The primary use of the nitrous oxide hurries the patient under and then the ether is employed. The oxygenand CO_2 are used to hurry recovery since small amounts of CO_2 stimulate the respiratory center so that the ether is rapidly eliminated. The present popularity of using ether by means of an apparatus by which air or oxygen bubbles through the anesthetic is probably not fully deserved. It has been shown by Mita (*Journal of Pharmacy and Chemistry,* 1926) that ether develops toxic properties proportionally to its exposure to light and air, this toxic action consisting in local necrosing effects and evil influences on the central nervous system. The custom of keeping the ether, after it is poured from the can in a colorless glass container, is unwise for the above reason and further the custom of adding fresh ether to the bottle from time to time results in a highly concentrated solution of impurities. It is therefore best to throw away residual ether and put fresh ether in the flask daily. McMechan has pointed out that these impurities even if present in percentages as low as the third or fourth decimal places are nevertheless capable of doing harm. Wilson and others have shown that convulsions may follow the use of stale ether, probably due to acetaldehyde, particularly in toxic cases. (*Lancet,* May 28, 1927.)

Instead of pushing the anesthetic so that very deep anesthesia is produced when an important nerve or organ is attacked, it is better to let up at this moment, since by this means pain is prevented, but the lower vital centers are not subjected to both shock and the drug in large amounts at the same moment.

A very cumbersome and complicated piece of machinery has been invented to deliver warm air-pressure ether vapor through the catheter. In an emergency the ether can be put in a Wolff bottle, which is immersed in warm water (not hot), and connected with an ordinary bulb and rubber reservoir, such as is used with an atomizer or Paquelin cautery. By this means the air is driven through the warmed ether and can pass to the rubber catheter introduced into the trachea.

In all cases the patient should be so anesthetized that the slightest degree of cyanosis should not be present.

Under the name of the A. C. E. mixture there is used a compound of alcohol, chloroform, and ether, which is but rarely used in America. (See Chloroform.)

Ether may be used as a local anesthetic in an atomizer spray, owing to the cold produced by its evaporation when it strikes the skin. Thus it is particularly useful in cases where *thoracentesis* or *paracentesis abdominis* is to be performed, and also in cases of superficial *neuralgia*, where the benumbing of the nerve often effects a permanent cure.

Ether anesthesia, induced by injecting ether into the rectum may be resorted to in certain cases as in operations about the face and head when a cautery has to be used in these areas. The plan is not as safe as the inhalation method, as there seems to be much greater danger of respiratory paralysis, severe inflammation of the bowel, and less opportunity of fitting the dose to the needs of each individual. Indeed Smirnoff records 485 cases with a death-rate of 1 in 200.

The ether is to be mixed with olive oil in the proportion of 3 to 1 for an adult but in many cases 1 to 1 is better, and it is well to fortify the ether by adding 10 grains (0.65) of chloretone, and the size of the dose is determined by the size of the patient. One ounce of the mixture is injected for each 20 pounds of body weight if the patient is an adult. Not more than 8 ounces should be used. Several hours before treatment the rectum should be washed out with an enema of soap and water. About one hour before the operation a hypodermic injection of morphine and atropine is given, for the double purpose of quieting the patient's general system and rendering the bowel tolerant, and fifteen minutes later the ether-oil mixture isi ntroduced as high as possible by means of a catheter attached to a funnel. The perianal region and buttocks should be anointed with petrolatum to protect these parts from the irritation of the ether. The injection should be slowly given. After the injection the catheter is clipped to prevent dripping as it is withdrawn. As induction of anesthesia by this method is slow the injection should precede the surgical procedure by about three-quarters to one hour. If anesthesia is not complete a few whiffs of ether may be given by inhalation. The anesthetic sleep usually lasts for several hours but as soon as the operation is over a speculum is introduced to permit the ether-oil mixture to escape and then the bowel is washed out with soap and water enema which is followed by the introduction of several ounces of pure olive oil which is allowed to remain. By this means irritation of the rectum is avoided. If at any time the narcosis seems too deep, some of the ether-oil is allowed to escape.

A modification of the plan just given has been relatively recently suggested by Gwathmey whereby morphine and atropine need not be given by the needle. Twenty minutes after the rectum has been washed out the following formula is given by rectal injection:

Morphinæ sulphatis	gr. ¼ (0.016)
Paraldehydi	fʒ ij (8.0)
Chloralis hydratis	gr. x (0.65)
Ætheris	ʒ j (30.0)
Olei olivæ	f℥j (30.0)

Misce and inject slowly during six minutes.

Forty minutes before operation a final injection of 3 ounces of ether and 1½ of oil are slowly injected. It will be observed that the patient is now under the effects of several powerful drugs.

Oral Administration.—When used internally, ether should be given in ice-cold water, or, better still, in capsule, in the dose of 30 minims to ½ ounce (2.0–16.0). If cold water is not used to dilute it, so great is the irritation of the fauces produced by the fumes of the drug that deglutition is difficult.

Internally, by the stomach, ether is very useful in *colic*, although for *flatulence* of adults and children spirit of ether is a more efficient remedy. (See Hoffmann's Anodyne.) In cases of *collapse* ether, given by means of the hypodermic needle or by the stomach, is of great service, particularly when cardiac action is very feeble, and it will give relief by inhalation in some of these cases more rapidly than the nitrite of amyl.

In *hiccough* a few inhalations of ether will often stop the spasmodic movements. In other instances 20 to 30 minims (1.3–2.0) is given intramuscularly. Sometimes a few drops scattered over the belly wall may arrest it. In severe whooping cough these doses may be given intramuscularly into the gluteal region but they are painful and may cause a slough unless strict asepsis is followed. Instead the ether may be used by the rectum in the proportion of 2 cc. in 15 cc. of olive oil and repeated three or four times in twenty-four hours.

Large doses of ether given by the mouth or hypodermically have been highly recommended in the treatment of *uremia*. They are most serviceable in the forms in which cardiac and respiratory complications are marked.

The *Spiritus Ætheris*, N. F. and B. P., is given in the dose of ½ to 2 drams (2.0–8.0). (See also Hoffmann's Anodyne.)

Contraindications.—Ether should not be used by inhalation in bronchitis or pulmonary tuberculosis or acute nephritis, because of its irritant properties; in peritonitis or gastritis, because it is apt to induce vomiting; in aneurism or in the presence of marked vascular atheroma, because it may rupture a bloodvessel by raising arterial pressure; nor in diabetes, lest it produce diabetic coma; and if anemia is present and an examination of the blood shows that the hemoglobin is below 50 per cent, the use of the drug should be avoided if possible.

ETHYL BROMIDE.

Æthylis Bromidum is obtained by distilling a mixture of alcohol, sulphuric acid, and bromide of potassium, and is a colorless fluid of neutral reaction, having a pleasant odor resembling chloroform. It evaporates with great rapidity, and any sample which does not do this is to be discarded. Poured on the hand, it should leave no fatty feeling. It should be remembered that the drug is decomposed by sunlight and when in prolonged contact with the air. In the presence of lamplight the fumes form bromal hydrate and bromine. The drug should be kept in dark-glass bottles. The physician should distinctly separate in his mind bromide of ethyl from bromide of ethylene. The latter is a chemical product possessing very dangerous properties, and should never be used in medicine. There is reason to believe that many of the unfavorable symptoms which follow the use of bromide of ethyl occur only when the drug is impure or is improperly used.

Physiological Action.—According to the studies of Thornton and Meixell in the author's laboratory at the Jefferson Medical College, the dominant action of the bromide of ethyl is on the respiratory, not on the circulatory system. This effect is depressant, but this influence is only met with after excessive doses. The blood-pressure falls under its influence to a slight degree, and the pulse is slowed through an influence probably exercised on the inhibitory nervous mechanism of the heart.

Therapeutics.—Bromide of ethyl is a useful anesthetic for short operations, such as opening boils or abscesses, or for the relief of the pain in other brief surgical procedures. Originally introduced into general use in this country by Levis, it has been found unsuited to major surgical cases, because if continued for a long time it seriously depresses the respiration. Bromide of ethyl has been found of the greatest value by Montgomery, of Philadelphia, as an anesthetic in labor and for minor gynecological operations in office practice. He found that the patient may be allowed to inhale the drug from a Hawley inhaler, for as soon as she has had enough to produce anesthesia the inhaler drops from her hand. The patient is also more obedient to the physician's directions, because of the fleeting influence of the drug, than when chloroform or ether is taken, and postpartum hemorrhage through uterine relaxation is not so apt to occur, but its use had never become popular.

A very great advantage possessed by bromide of ethyl is the rapidity of its action. A few whiffs are generally all that is needed to cause anesthesia. It rarely produces disagreeable effects. Cases of sudden death under its use are, however, on record, and in some instances nervous twitchings, and even tetanic spasms, have been known to accompany its employment. These tetanic symptoms are, however, fleeting and generally of little importance. Nausea and vomiting rarely follow its use, but it is apt to leave an unpleasant garlic-like taste in the mouth, and a similar odor of the breath is frequently noted for several days after its use.

Administration.—Bromide of ethyl should be administered for but a brief period, but when taken should be inhaled freely. It cannot be given carelessly with good effect. If a good sample is employed, 45 minims to 3 drams (3.0–12.0) is a sufficient amount to induce anesthesia. This quantity should be used at once, instead of added to the inhaler drop by drop, as in the case of chloroform, and the cloth or inhaler should be held close to the mouth and nose, instead of at a little distance, as is often necessary with other anesthetics.

ETHYL CHLORIDE.

Ethyl chloride (*Æthylis Chloridum*, U. S. and B. P.), on account of its extreme volatility, should be preserved in hermetically sealed metal tubes as it is decomposed by sunlight, and kept in a cool place, far from lights or fire. It is a colorless, very volatile liquid, having a peculiar, rather agreeable odor. The gas is very inflammable, and consequently it should not be used in proximity to a gas-flame or fire. It is often used in the form of a spray, as is methyl chloride, for the purpose of producing anesthesia by freezing that part of the body with which it is brought into contact.

Physiological Action.—Careful investigations show that ethyl chloride is a direct depressant to the heart muscle, but by no means so powerful in this influence as is chloroform. In other words, the difference is a variation in degree and not in kind. Chloroform is nineteen times as powerful in this respect. So, too, ethyl chloride may cause a fall of blood-pressure, aside from its depressant effect upon the heart, by relaxing the bloodvessel walls, but to a far less degree than chloroform. It also decreases cardiac activity by stimulation of vagus centers in the medulla and not by any reflex irritation. Ethyl chloride depresses the respiratory center partly by its direct influence and partly by the fall of blood-pressure, whereby this center is deprived of blood. When used for anesthetic purposes these effects are all very moderate and only become important if cardiovascular disease is present, but if the drug is too freely used sudden death may occur.

Therapeutics.—Ethyl chloride is used not only as a local anesthetic by virtue of its freezing properties, but also by inhalation. There are differences of opinion as to the best manner of using ethyl chloride as an anesthetic by inhalation. By some it is claimed that it is necessary, because of its great volatility, that it should reach the patient in concentrated form, and not have an opportunity to be dissipated into the surrounding air without first entering the lungs and that for this reason it should be used by the aid of a mask such as that employed in the administration of nitrous oxide gas. The mask should be applied in such a way as to cover tightly the nose and mouth, and the ethyl chloride is then projected onto a compress which is placed inside of it. Where it is impossible to obtain an inhaler made for this purpose, a tin or glass funnel may be used as a substitute. The large end of this may be placed over the mouth and nose. The neck of the funnel contains loose absorbent cotton. Through the small end of the funnel the chloride of ethyl is sprayed upon the cotton. By the careful adaptation of the hands to the sides of the funnel and the cheeks it is possible to make this a very close inhaler.

Other anesthetists assert that this concentrated method greatly increases the danger and advise that the drug be dropped or sprayed on an inhaler like that used for chloroform (see Chloroform). This plan is of course very wasteful of the drug but undoubtedly much safer.

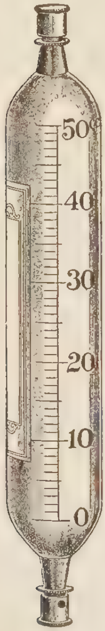

Fig. 49.—The cap unscrews and the drug escapes as a fine spray through a small hole in the end of the glass.

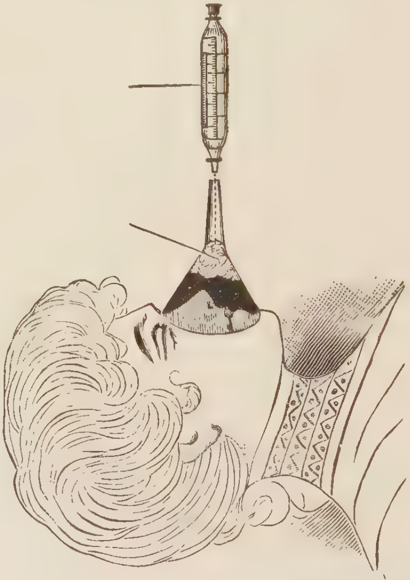

Fig. 50.—Showing use of a glass funnel as an inhaler for ethyl chloride.

A good way to keep ethyl chloride is in the form of a graduated glass container, so constructed that the drug is measured as the spray is forced from it by the heat of the hand. The drug is placed upon the market for this purpose in graduated glass containers.

Anesthesia produced by the closed method usually develops within fifteen to twenty seconds, and it is claimed that there are very slight changes in the pulse and respiration under its influence—1 or 2 drams (4.0–8.0) of ethyl chloride are usually sufficient to produce an anesthesia lasting from five to ten minutes. Larger amounts than this may be employed when a longer anesthesia is desired. It is a noteworthy fact that the pupillary and corneal reflexes are not lost under its influence except in children, but the pupils usually widely dilate as anesthesia is induced. This drug cannot be used as an anesthetic when muscular relaxation is indispensable. After the drug is removed the patient rapidly recovers consciousness and often experiences no unpleasant symptoms, although vomiting may occur in some cases. It is, so far as is yet determined, a fairly safe anesthetic, but it must be used with care, for the zone between safety and danger is very narrow. The death-rate under its use is below that of chloroform. In 2550 cases recorded by Lotheisen 1 death occurred under its effects, but this may have been due to organic disease of the coronary arteries, which was present. Seitz has collected 1600 cases with 1 death due to disease of the coronary arteries. Miller has collected 43,796 cases with 5 deaths, or 1 in 8759 anesthesias, and Hornabrook of Melbourne states that in a period of twenty-three years it has been given to 75,000 patients with only 2 deaths, but he insists on free access of air and that the anesthetist be well trained.

Ethyl chloride is often used to produce primary anesthesia before giving ether but it should never to proceed chloroform as their effects are too similar. (See Chloroform.)

Chloride of ethyl is contraindicated if there is any obstruction in the air-passages, upper or lower. Serious valvular disease of the heart or myocardial degeneration also contraindicate it, and ether is probably safer under these conditions. If cyanosis develops during its use the drug must be withdrawn at once. It is noteworthy that alarming symptoms when they occur develop with great rapidity. These symptoms are of two types, spasmodic and those characterized by great respiratory depression. In the spasmodic type there is risus sardonicus, a condition like lockjaw and crowing respiration. This spasm may extend to the entire body, and is accompanied by very deep cyanosis. In the respiratory type the patient is generally relaxed and the respirations become increasingly shallow even if the rate is not altered. The condition is one of collapse, with dilated pupils. The jaws if fixed should be opened, the tongue drawn out and artificial respiration instituted.

The dose varies from 2 to 3 cc. in a child to 4 or 5 cc. for a man. The drug should not be pushed too freely at first and the patient should not be deprived of air, except early in the use of the drug. Telford and Falconer have shown that ethyl chloride may cause postanesthetic toxemia. (See Chloroform.)

ETHYLENE.

Ethylene, $CH_2 : CH_2$ is being used more and more in place of the older anesthetics for surgical anesthesia. It is essential that it be pure and not contaminated by carbon monoxide. It has a sweet molasses-like odor which is not more disagreeable than is that of ether. In its administration it is to be borne in mind that when mixed with air it possesses explosive properties and when it is used as an anesthetic no object such as a cautery or other source of live heat should be used near the table. If it is necessary to use a cautery or electric knife or needle the inhaler and the container should be taken out of the room or to a distance. Electric switches should not be moved unless they are vapor proof and high frequency machines are to be excluded. Further, it is quite possible for the mixture to be exploded by static electricity and, therefore, the operating table should be grounded by means of a wire or metal chain reaching the floor, and this is also true of the inhaler. The higher the humidity of the air in the operating room the less the danger of static. An humidity of 54 per cent or more is desirable. This can be regulated by having a hygrometer in the room.

The gas is always used in conjunction with oxygen (proportion 9 to 1) and when so used is said not to materially lower blood-pressure or to depress the heart. After anesthesia is complete a proportion of 8 to 1 of oxygen is often adequate. It does not irritate the kidneys.

Training is essential for its employment, as is the case with nitrous oxide. It is best to precede its use by morphine and atropine.

The advantages of ethylene-oxygen anesthesia may be stated as follows: It usually produces some muscular relaxation which nitrous oxide does not, which is particularly useful in abdominal surgery and in traumatic cases when fractures or dislocations are to be reduced. When it fails to relax, give ether. It does not induce a free secretion of mucus in the respiratory tract as does ether. It produces anesthesia very rapidly, on the average in three minutes, and the patient awakes promptly when it is stopped. The respirations are quiet and resemble those of sleep. The skin remains of good color and there is no sweating. At the slightest sign of cyanosis the ethylene should be cut down and the oxygen intake should be increased until a normal color returns. The pulse is not greatly altered in speed. While many patients vomit after its use this may be largely put aside by administering carbon dioxide as soon as the use of ethylene is discontinued to stimulate the respiratory center to eliminate the ethylene. (See Carbon Dioxide.) Pulmonary complications are rare.

Ethylene does not give complete muscular relaxation as do the older anesthetics and, therefore, is not suitable for operations on the upper abdomen and in cases of fractured bones when anesthesia is required.

The additional disadvantages are the necessity of using cumbersome apparatus; no more cumbersome, however, than the ordinary ether-oxygen-nitrous-oxide machines. As the gas is marketed under compression in cylinders there is always danger of a leak at a control valve so that the gas escapes in the room or closet rendering an explosion likely. This fact requires adjustment as to fire insurance. When a cylinder is placed on a stand with one of nitrous oxide great care must be taken that the valves are so adjusted that no mixture of these gases can take place unless it be under low pressure at a central mixing valve or bag. The exhaled gas may explode and Salzer states that he has the expiratory valve connected with a hose leading out of doors; to prevent such an accident. Dixon, of Manchester, has shown that nitrous oxide is more active than oxygen in supporting the ignition and explosion of ethylene, but Horner and Gardiniere

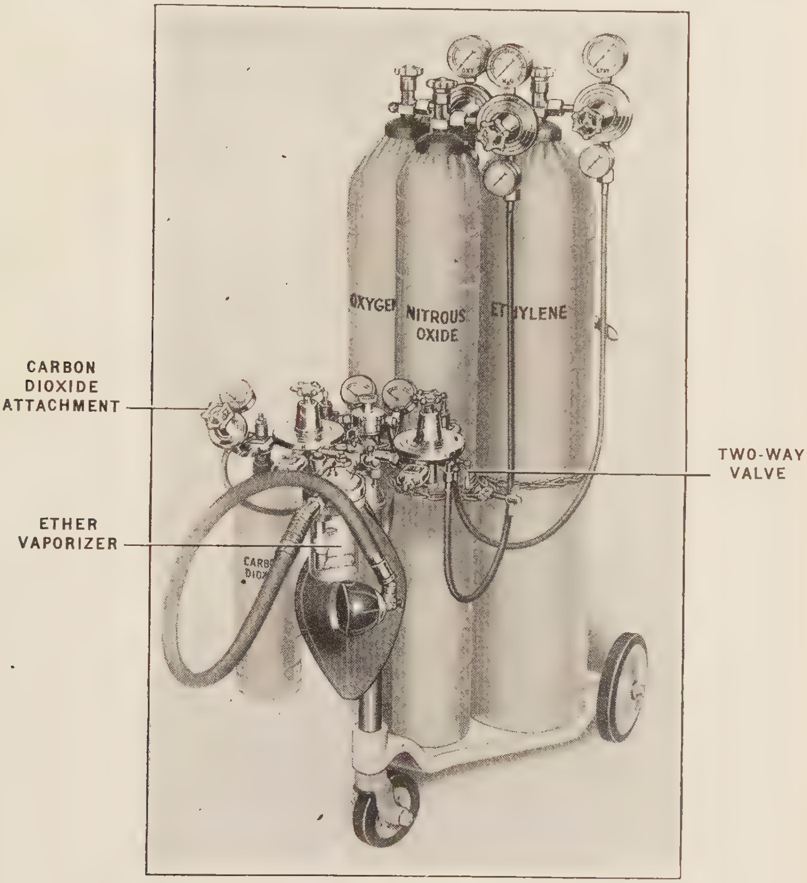

Fig. 51.—Modern hospital outfit for the administration of nitrous oxide, ethylene, oxygen, carbon dioxide and ether. (Heidbrink Company.) Details as to the use of this apparatus are obtainable with the apparatus.

have shown that a small percentage of carbon dioxide distinctly retards explosibility if added to a mixture of ethylene-oxygen.

It is evident that ethylene may have a sphere of usefulness in a limited class of patients in institutions where anesthetists are trained in its use but that for ordinary surgical purposes it is not practical. This is more true because one of the largest producers of this gas, after stating that every precaution is taken to make it pure, states that "all sales are made with the understanding that the buyers assume all risk of every kind after acceptance of delivery." The apparatus may freeze by reason of rapid evaporation. This can be prevented or overcome by the use of hot towels. Oozing from the wound is greater than with ether, but no greater than with nitrous oxide. A wet towel around the patient's head decrease the danger of static spark.

ETHYLHYDROCUPREIN.

Ethylhydrocuprein (trade name "Optochin") is without doubt an efficient destroyer of the pneumococcus not only *in vitro* but *in vivo*. The recognition of the fact that *croupous pneumonia* is a general infection, with the chief lesion in the lungs, makes it a drug of promise and statistics indicate that if fairly full doses are used early it diminishes the mortality from this disease. After the exudate is well formed in the lung it does not materially hurry resolution and the pneumococci in the exudate are protected from the drug. If improvement does not follow its use during the first three days of the disease it is useless. The greatest objection to its use in efficient doses is that it has so great a toxic effect upon the optic nerve and retina that it may produce not only temporary amblyopia but permanent blindness. Doses of 4 grains (0.25) every five hours for three days, exercise a bactericidal effect in the blood, but these doses approximate those which may produce toxic effects. The daily amount by the mouth should not be in excess of 25 grains (1.6). Smaller doses may be used with safety to help the body destroy the coccus. It may be given in solution, or in capsule if followed by plenty of water, as it is prone to irritate the stomach. It is to be noted that the "base," not the hydrochloride, is to be used in pneumonia, and given with milk, which will prevent the acid of the stomach from converting it into the hydrochloride. It may be given in capsule or suspended in simple syrup followed by milk. In the strength of only ½ grain (0.03) to the pint of a 1 to 1500 solution of thymol it is efficient in *pneumococcus sore-throat* when used as a gargle, but it is very bitter.

When the *pneumococcus meningitis* is present the *hydrochloride* is to be used, not the "base." Kolmer advises the intraspinal injection of 1 cc. of a 1 to 500 sterile salt solution to each 5 pounds of the body weight of the patient every twelve hours and once a day as long as living pneumococci are found in the spinal fluid.

EUCAINE HYDROCHLORIDE AND LACTATE.

Eucaine hydrochloride (*Eucainæ hydrochloridum*, U. S.) is a synthetic substance having a chemical formula closely resembling that of cocaine. The drug is marketed as a substitute for cocaine, it being claimed that it does not affect the heart as does the latter drug. Eucaine does not cause a primary contraction of the bloodvessels when locally applied, as does cocaine, but a hyperemia of the parts affected. Two forms of eucaine have been used, eucaine "A" and eucaine "B;" but the latter is now exclusively employed for local anesthesia, and for use in ophthalmic and genito-urinary surgery. A solution of eucaine can be sterilized by boiling without impairing its properties. Used by the process for producing infiltration anesthesia (see Cocaine and Procaine), eucaine causes considerable pain before acting as an anesthetic. For infiltration it should be used dissolved in the following formula and warmed before being injected:

℞—Eucainæ hydrochloridi β	gr. j (0.06)
Sodii chloridi	gr. x (0.6)
Aquæ destillatæ	f℥iij (90.0)

In ophthalmic practice it is employed in 2 per cent solution, and to ordinary mucous membranes in 5 per cent solution—that is, 25 grains (1.6) to the ounce (30.0) of water. One advantage of eucaine is that it forms a permanent solution with water in 3.5 per cent strength.

Beta-eucaine lactate (*Benzamine lactas*, B. P.) has been introduced to take the place of the hydrochloride, as it is very much more soluble.

Eucaine hydrochloride possesses a distinct disadvantage in its inability to cause primary contraction of the bloodvessels when locally applied, and this effect of cocaine is often most valuable to overcome local engorgement. Further, it causes severe smarting pain when dropped into the eye.

Eucaine is capable of producing systemic effects resembling those due to overdoses of cocaine, and these must be treated by the use of strong coffee, alcohol, digitalis and strychnine. If the case is urgent, ether and ammonia may be used as rapidly acting stimulants.

EUCALYPTUS.

Eucalyptus is the leaves of *Eucalyptus globulus*, or blue-gum tree, a native of Australia, but grown at present all over the world. Its chief medicinal constituent is the oil of eucalyptus (*Oleum Eucalypti*, U. S. and B. P.), from which is derived *Eucalyptol*, U. S., obtained by distillation. The oil of eucalyptus and eucalyptol are used for the same purposes, but the latter is the refined product of the former.

Physiological Action.—Locally applied, the oil is a decided irritant. 10 to 20 minims (0.6–1.3) taken internally cause slight stimulation, followed by a sense of calm; while larger doses produce disturbed digestion and loose stools of oily odor. The pulse is increased in frequency and force, and intense headache may come on. After very large doses there is a fall in pulse-force, bodily temperature, and strength of limb, and the respirations are decreased. A peculiar loss of sensation in the lower limbs may occur. If death takes place, it is due to respiratory failure. The drug is eliminated by the skin, kidneys, bowels and lungs. The urine may have the odor of violets, as it sometimes does after the use of oil of turpentine.

The oil of eucalyptus has considerable antiseptic power.

Therapeutics.—Oil of eucalyptus has been used in *malarial fever* where quinine could not be borne by the patient owing to idiosyncrasy. It is probably of little value. In *bronchitis,* in an emulsion or in capsule, it is of great value in the later stages (see Bronchitis), since in its elimination by the lungs it acts locally upon the inflamed mucous membrane. It may be used in the subacute forms of *gonorrhea.* The following prescription will answer:

℞—Olei eucalypti . . . . f℥j (4.0)
Olei amygdalæ expressi . . . . f℥j (4.0).—M.
Pone in capsulas, No. x.
S.—One t. i. d. after meals.

Eucalyptol, U. S., is obtained from oil of eucalyptus, and is largely employed by rhinologists and others in lotions and other nasal applications. It may be used in solutions of fatty oils, but is insoluble in water, although it is soluble in alcohol and ether.

Administration.—The fluidextract, which is no longer official, is given in the dose of 10 minims (0.6) to 2 drams (8.0), the oil (*Oleum Eucalypti,* U. S. and B. P.) in the dose of 5 minims (0.3), ½ to 3 minims (0.03-0.18), B. P. The dose of eucalyptol is 5 minims (0.3) in capsule.

Trochiscus Kino Eucalypti and *Unguentum Eucalypti* are official in the B. P., but are seldom used.

EUONYMUS.

Euonymi Cortex, B. P., or Wahoo, is the dried bark of *Euonymus atropurpurea,* a native plant of the United States. It contains an active principle, *Euonymin,* B. P. As a laxative its action is very slow and mild; it is thought to act particularly on the liver and may be used when moderate *hepatic torpor* is present.

Administration.—The dose of the solid extract (*Extractum Euonymi,* is 3 to 10 grains (0.2–0.6), of the fluidextract, the dose is 1 to 2 fluidrams (4.0–8.0). Of euonymin the dose is ½ to 1 grain (0.03-0.06).

EUPHORBIA PILULIFERA.

This herb is sometimes called snake-weed or cat's-hair, and is a native of Australia and the West Indies, where, like stramonium, it grows profusely as a weed by the roadside.

Physiological Action.—In toxic doses the drug kills small animals by failure of the respiration and circulation, these two vital functions being greatly affected by doses which exert no great influence on the rest of the body. In full dose it may cause some gastric irritation.

Therapeutics.—Euphorbia pilulifera is one of the remedies introduced into medicine for the relief and cure of *asthma,* in which disease the results obtained, after other remedies fail, are very extraordinary if the reports of those who have given it a thorough trial can be accepted without reserve. As yet we do not know the form of asthma which is most relieved by its use, and its employment is purely empirical. It has also been highly praised in the treatment of *chronic bronchitis* and *emphysema.*

Administration.—Euphorbia pilulifera is best given in the form of the fluidextract in the dose of 30 minims to 1 dram (2.0–4.0). The decoction is made by adding a "handful of stalks with the leaves on them to 2 quarts (2 liters) of boiling water, and boiling down to 1½ quarts (1½ liters)." Of this decoction the dose is a small wineglassful (60.0) three times a day. (See Asthma.)

EUPHTHALMIN.

Euphthalmin is a synthetic alkaloid, a derivative of beta-eucaine, sometimes called eucatropine, used as an active mydriatic. It possesses an effect upon the general system very like that of atropine, but when first dropped into the eye may cause slight salivation through irritation of the secretory fibers of the chorda tympani which it reaches after absorption. The pupil under its influence begins to dilate in from fifteen to twenty minutes after a few drops of a 2 to 10 per cent solution are instilled. The maximum dilatation is reached in about one hour, and disappears in about five to eight hours. Vinci states that the mydriasis is due to paralysis of the oculomotor nerve endings, and that the sympathetic is not affected.

EUPHYLLIN.

(SEE TEXT UNDER THEOCIN).

EUQUININE.

Euquinine, or *Quininæ Æthylcarbonas,* U. S., occurs as delicate white needles, which are tasteless. It is slightly soluble in water, but readily so in alcohol, ether, and chloroform. When placed in acid mixtures it becomes bitter. Euquinine is used as a substitute for quinine, particularly for children, who dislike the bitter taste of the older drug and cannot take pills or capsules. Dose the same as quinine.

FLAXSEED.

Flaxseed or linseed (*Linum*, U. S.) is the seed of *Linum usitatissimum*, or flax from which linen is made; it is official in the B. P. as *Lini Semina*. These seeds contain an oil and a mucilage, the first of which is largely used in the arts, and the second is sometimes employed in medicine. The oil (*Oleum Lini*, U. S. and B. P.), is also used by physicians and pharmacists for various purposes.

Therapeutics.—Flaxseed acts as a demulcent to *inflamed mucous membranes*, and is used largely in the treatment of *acute cystitis*, *bronchitis*, *gastritis* and similar states, in the form of flaxseed tea. This is prepared by mixing together 3 drams (12.0) of flaxseed, not ground, 30 grains (2.0) of extract of liquorice, 10 ounces (300.0) of boiling water, and allowing the mixture to stand one to four hours in a warm place. If the mixture is boiled, the oil is set free and makes the dose disagreeable. This infusion may now be made more tasteful and useful by the addition of a little lemon-juice and sugar and by the placing of from 1 to 2 drams (4.0 8.0) of gum arabic in the pitcher containing it. If the cough is excessive, a little paregoric may be added. Linseed oil is used sometimes as a laxative in the dose of 2 ounces (60.0), and is said to be of service when so given in the treatment of *hemorrhoids*.

Flaxseed meal (*Lini Farina*) when moistened is employed universally as a useful poultice.

Under the name of Carron oil (*Linimentum Calcis*, U. S.) an emulsion of lime-water and linseed oil, equal parts, is a little used old fashioned application for *limited* or *extensive burns*.

FORMIDINE.

Formidine is a condensation product of iodine, formaldehyde, and salicylic acid, and is a true chemical compound. It appears as a reddish-yellow powder which is practically tasteless, but possesses a slight odor of iodine. It is insoluble in water, dilute acids, alcohol and most ordinary solvents, but is slowly soluble in alkaline solutions. Brought in contact with the juices of the tissues, it slowly dissolves and separates into its constituent bodies.

Formidine is used externally as a dusting-powder for *wounds*, or, in other words, as a substitute for iodoform, as it possesses no disagreeable odor, is non-irritating, and strongly antiseptic. It may be applied either in dusting-powder, ointment, suspended in oils, or upon bandages, or it may be diluted with the various dusting-powders, such as talc, oleate of zinc, or bismuth.

Internally it may be given as an intestinal antiseptic, as it is not dissolved in the stomach. The best method of administration is to give it stirred up in water, milk, coffee, or chocolate. The dose is 5 to 10 grains (0.3-0.6). Large doses, given to animals, seem to prove that it does not produce toxic symptoms.

FORMIC ALDEHYDE (FORMALDEHYDE).

Formic aldehyde is a gaseous body difficult of application because of its physical characteristics, but nevertheless possessing very great power as a disinfectant or germicide. It is prepared by subjecting methyl alcohol to oxidation, and almost every instrument maker has a device whereby this gas may be generated, and the room formerly occupied by a sick person thereby disinfected far more efficaciously than can be accomplished by burning sulphur. Some of the smaller types of apparatus are, however, quite inadequate. The doors and windows of the room should be tightly shut during the process of disinfection and for several hours after the formaldehyde generator is exhausted. As the gas is exceedingly irritating to the eyes and respiratory passages, no one should attempt to enter the room. The moistening of fabrics aids the gas in destroying germs. After the disinfection is completed the room should be aired for many hours, or, if it must be used soon, it may be rendered capable of habitation by spraying a 20 per cent solution of ammonia to neutralize the acid atmosphere. The great advantage of formaldehyde for disinfectant purposes is the fact that it permeates every nook and cranny, and yet does no injury to colored fabrics, as does chlorine gas under similar circumstances. The safety, efficiency, and cheapness of formaldehyde gas as a disinfectant, and of the solution, render this agent a most valuable one. (See Disinfection.)

Liquor Formaldehydi, U. S. and B. P., is an aqueous solution of formaldehyde which contains 37 per cent, by weight, of the gas. It forms a clear, colorless liquid of a pungent odor, which is exceedingly irritating to mucous membranes. It can be mixed with water and alcohol in all proportions, but on standing its solution becomes milky because of the separation of paraformaldehyde. It should be kept in a cool place protected from light.

This official solution of formic aldehyde, in the strength of 37 per cent, has been widely used of late for disinfectant and antiseptic purposes. For all these purposes it is usually diluted still further by the addition of water. A 1 per cent solution is usually quite active enough for surgical antisepsis, and is far less poisonous than is the bichloride of mercury. A similar percentage, or a little stronger, may be used to preserve pathological specimens, and in the proportion of 1 to 32,000 it will preserve milk for several days. Taken internally, in small amounts well diluted, it does not possess any toxic properties, but if its quantity is large or it is in concentrated form it acts as an intense respiratory and gastric irritant. The chemical antidote is ammonia water, or the aromatic spirit of ammonia, well diluted with pure water.

Concentrated undiluted formaldehyde solution may be used for the purpose of cauterizing *syphilitic sores*, and it is the *specific treatment for the bites of rabid animals.*

Formaldehyde is useful when locally applied to check *excessive fetid sweating*, by virtue of its antiseptic effect and because it hardens and contracts the skin. The solution used may be made by diluting the 37 per cent commercial solution with 4 to 6 parts of water. Diluted in the proportion of 1 to 6 of water it may be employed as a lotion to the entire body to check *colliquative sweats.*

One teaspoonful (4.0) of the official solution placed in 3 ounces (90.0) of sweetened water is a most excellent solution with which to kill flies, who greedily take it and speedily die.

Numerous cases of poisoning by the accidental or suicidal ingestion of formaldehyde solution have been recorded. The symptoms consist in epigastric pain which soon becomes diffused and which is usually immediate and severe in onset, accompanied by repeated vomiting of blood-stained mucus. Sometimes unconsciousness comes on almost at once and often lasts for many hours, the symptoms resembling those of apoplexy. The suddenness of onset depends chiefly upon whether the stomach is empty. When it is full of food or liquid, the symptoms do not develop so rapidly. There seems to be no doubt that the ingestion of a large dose may produce death within a very few minutes in rare cases. Intense inflammation of the uvula, pharynx, gullet, and stomach develops, and at autopsy these parts are often found eroded and leather-like in character. Fatal results in adults have followed the ingestion of 3 ounces of the ordinary formaldehyde solution. The smell of the vomit is diagnostic. The chemical antidote is ammonia water, well diluted, or any one of the ammonium salts, well diluted, such as ammonium acetate. The stomach should then be washed out, and soothing drinks, such as sweet oil and starch-water, given with morphine hypodermically for the relief of pain.

GALLIC ACID.

Acidum Gallicum (B. P.) is usually prepared from tannic acid.

Physiological Action.—Gallic acid is an astringent, but not a coagulator of blood. Locally applied in bleeding, it is useless, but given internally in hemorrhages which cannot be acted upon by the direct local application of tannic acid, it was thought to be useful as a hemostatic. This is very doubtful. It is eliminated from the body by the kidneys as gallic acid.

Therapeutics.—Gallic acid has been used in *albuminuria* dependent upon a relaxed, atonic state of the kidneys and in *acute* or *chronic* *diarrhea* with advantage. In the form of the ointment it is useful in the treatment of *psoriasis,* and in the cure of *ulcers* and *sores* which are actively discharging. A very useful application to *external hemorrhoids* is equal parts of stramonium ointment and gallic acid.

Administration.—Gallic acid is given in the dose of 2 to 40 grains (0.12–2.6) in pill or solution. It ought never to be used with any salt of iron, as it is chemically incompatible. The preparation used locally is *Unguentum Acidi Gallici.*

Nut-gall.

Nut-galls (*Galla,* U. S. and B. P.) are the small excrescences found upon the oak (*Quercus infectoria*) formed by the ova of the fly *Cynips tinctoria.* Their sole value depends upon the tannic acid contained in them. The ointment (*Unguentum Gallæ,* U. S. and B. P.) and *Unguentum Gallæ cum Opio,* B. P., are used as astringent and sedative applications.

GAMBIR.

Gambir, U. S., is an extract derived from the leaves and young shoots of *Ourouparia gambier.* It takes the place heretofore held by catechu. Gambir depends for its medicinal value upon the astringent properties which it possesses. Beyond this power it has no particular value.

It is of a dark red color, has a somewhat sweetish taste, and is insoluble, like most extracts, in water.

Therapeutics.—Like all the vegetable astringents, gambir is used as a remedy for *diarrhea,* particularly that of the serous type or that in which the stools are of too fluid a consistence. If large amounts of mucus in the passages show a catarrhal state of the bowel, the mucus should be displaced by a purge of castor oil or sulphate of magnesium before the astringent is used.

Gambir may or may not be combined with opium in cases of diarrhea, and the following prescription will be found of service in many instances:

For an adult:

℞—Tincturæ gambir compositæ	f℥ij (60.0)
Tincturæ opii camphoratæ	f℥ij (60.0)
Misturæ cretæ	f℥ij (60.0).—M.

S.—Dessertspoonful (8.0) every four hours until relieved. To be shaken before using.

In cases of *sore-throat* where the secretion is excessive and the inflammation subacute, gambir may be used as a gargle.

In cases of *spongy gums* gambir is sometimes useful as a mouthwash. If the powdered gambir is used internally, the dose is 20 to 30 grains (1.3–2.0). The dose of the compound tincture of gambir (*Tinctura Gambir Composita,* U. S.) is 1 to 2 fluidrams (4.0–8.0). Its only constituent besides the gambir is cinnamon. The troches of gambir (*Trochisci Gambir*, U. S.) are employed in sore-throat, and are to be held in the mouth. They are not generally used.

In the B. P. gambir is still official as catechu and the following preparations are also official: Trochiscus Catechu; the tincture (*Tinctura Catechu*), dose ½ to 1 fluidram (2.0-4.0); and a compound powder (*Pulvis Catechu Compositus*), composed of catechu, kino, and rhatany, the dose of which is 10 to 40 grains (0.6–2.6).

GAULTHERIA.

Wintergreen, or *Gaultheria procumbens*, is an American evergreen containing a volatile oil. The oil possesses a peculiar, exceedingly penetrating odor and a warm aromatic taste. It is about 96 per cent salicylate of methyl. The *Salicylate of Methyl* (*Methylis Salicylas*, U. S.) is derived from the oil or as an artificial product.

Physiological Action.—Owing to the large amount of salicylate of methyl contained in the oil, its physiological action is almost identical with that of salicylic acid. (See Salicylic Acid.)

Therapeutics.—Aside from its use as a flavoring substance, oil of gaultheria may be used in place of the ordinary salicylates in all forms of *rheumatism* in which they are useful. This oil is best given in capsules or emulsion or dropped on a teaspoonful of sugar three times a day after meals. The dose may be as high as 100 minims (6.6) a day, but if 60 minims (4.0) three times a day are without effect, pushing it further is useless. Very few patients can take more than 30 minims a day without suffering from a disordered stomach. Cases of death in coma with intense cyanosis from the ingestion of as little as 12 cc. have been recorded.

Lannois and Limousin have highly recommended the application of this oil to *acute* and *chronic rheumatic joints*. The oil is placed on lint, and then the lint is wrapped around the part affected, evaporation being prevented by applying a gutta-percha covering. They assert that this treatment gives rapid relief, although they admit that after it the skin may desquamate.

GELSEMIUM.

Gelsemium, N. F., and *Gelsemii Radix*, B. P., or yellow jasmine, as used in medicine, is the dried rhizome and roots of *Gelsemium sempervirens*. It contains two alkaloids, gelsemine and gelseminine.

Physiological Action.—NERVOUS SYSTEM.—Gelsemium paralyzes the spinal cord, particularly on its sensory side, although the motor side is certainly ultimately depressed. It does not influence the nerves or muscles except those of the head, on which it acts as a paralyzant, particularly affecting the motor fibers.

CIRCULATION.—Gelsemium is a depressant to the circulation, acting particularly on the heart. It paralyzes the vagus and lowers blood-pressure.

RESPIRATION.—Gelsemium kills by paralyzing the respiratory centers (Sanderson, Ringer, and Murrell).

TEMPERATURE.—In overdose the drug lowers bodily heat very markedly.

EYE.—Gelsemium is a mydriatic of considerable power, causing, when dropped into the eye, wide dilatation of the pupil, a result due to paralysis of the oculomotor nerve peripherally.

Therapeutics.—Gelsemium is used in *headache* and *migraine* depending on nervous troubles or upon *eye-strain*. It is particularly useful in combination with cannabis. (See Cannabis and Migraine.)

In *malarial fever* it is said to be of service, but this is doubtful. In the early stages of *pneumonia* and *pleurisy* as a substitute for aconite it was highly spoken of by Bartholow.

Gelsemium has also been found of value in *asthma, whooping cough, laryngismus stridulus*, and *nervous cough*. In localized *muscular spasm*, such as is seen in *torticollis* or *wryneck*, and in *spasmodic dysmenorrhea*, it is of considerable service. It ought not to be used if the system is already depressed, but only in sthenic cases.

When used as a *mydriatic*, Tweedy recommended gelsemine as equal to atropine in effect, but much more transient in its influence. He used 8 grains of commercial gelsemine to the ounce (0.5–30.0) of water instilled, drop by drop, into the eye every fifteen minutes for one hour, and then every half-hour for two hours.

Poisoning.—The most prominent symptoms of gelsemium poisoning are ptosis and dropping of the jaw. These are preceded by a sensation of languor, a desire to lie down, relaxation and muscular weakness. Gelsemium is apt to cause temporary internal squint, owing to its paralyzant action on the sixth pair of cranial nerves. The pulse becomes rapid and feeble, the skin wet and cold, the face pinched and anxious, the voice is lost, and death ensues from centric respiratory failure and an almost simultaneous cardiac arrest. Sensation in man is impaired very late in the poisoning.

The treatment of the poisoning consists in the use of cardiac stimulants, such as ammonia and digitalis, the application of external heat, and the employment of atropine and strychnine for the purpose of stimulating the respiratory center. Emetics and the stomach-pump are, of course, to be employed if the patient is strong enough.

Administration.—The fluidextract (*Fluidextractum Gelsemii*, N. F.) is given in the dose of 2 to 5 minims (0.1–0.3) and the tincture (*Tinctura Gelsemii*, N. F. and B. P.) 5 to 15 minims (0.3–1.0). *Extractum Gelsemii* is given in the dose of ¼ grain (0.015). In some parts of the United States physicians largely employ a very strong unofficial tincture of gelsemium, the dose of which is 1 to 2 minims. Gelsemine and gelseminine should not be given internally.

GENTIAN.

Gentiana, U. S., contains gentianine and gentisic acid, and has a bitter taste. This drug is official in the B. P. as *Gentianæ Radix.*

Therapeutics.—Gentian is one of the most efficacious bitter tonics that we possess. In the *anorexia* following acute diseases and in cases of *gastric atony* with *dyspepsia* it is of value. Combined with bicarbonate of sodium, it is of great service in the treatment of the subacute *gastric* and *intestinal catarrh* of children.

Administration.—The compound tincture (*Tinctura Gentianæ Composita,* U. S. and B. P.) is given in the dose of 1 to 2 drams (4.0–8.0), ½ to 1 fluidram (2.0–4.0), B. P., the fluidextract (*Fluidextractum Gentianæ,* N. F.) in the dose of 30 minims to 1 dram (2.0–4.0), and the solid extract (*Extractum Gentianæ,* N. F. and B. P.) in the dose of 1 to 8 grains (0.06–0.5). *Infusum Gentianæ Compositum,* B. P., is given in the dose of ½ to 1 fluidounce (15.0–30.0). The compound tincture and compound infusion are composed of gentian, bitter orange peel, and cardamoms. The following prescription is an excellent one for use in convalescence from prolonged fevers:

℞—Acidi nitrohydrochlorici diluti	f ʒj vel f ʒij (4.0–8.0)
Tincturæ nucis vomicæ	f ʒj (4.0)
Tincturæ cardamomi compositæ . . .	f ℥ij (60.0)
Tincturæ gentianæ compositæ . q.s. ad	f ℥iv (120.0).—M.

S.—Teaspoonful (4.0) in water after meals.

GINGER.

Zingiber, U. S. and B. P., is the rhizome of *Zingiber officinale.* Black ginger is the dried rhizome with its bark, while white ginger has this covering removed. It contains a hot volatile oil and an aromatic resin, and is largely used in domestic medicine as a carminative and stomachic. In the treatment of *menstrual cramps* it is often given, and is particularly useful in those cramps due to suppression from exposure to cold. Ginger is often combined with purgative medicine to prevent griping and for its pleasant flavor. It is decidedly constipating, and when used in *diarrhea* mixtures is of value other than as a flavoring addition to the prescription.

Administration.—The fluidextract (*Fluidextractum Zingiberis,* U. S.) is given in the dose of 10 to 30 minims (0.6–2.0), well diluted; the tincture (*Tinctura Zingiberis,* U. S. and B. P.), dose 20 minims to 2 drams (1.3–8.0); the syrup (*Syrupus Zingiberis,* U. S. and B. P.), dose 30 minims to 2 drams (2.0–8.0), ½ to 1 fluidram (2.0–4.0), B. P.; the oleoresin, dose ½ to 1 minim (0.03–0.05), well diluted or in pill. The troches (*Trochisci Zingiberis*) are used as stimulants to salivary secretion.

GLANDULAR EXTRACTS.

Within the past four decades physiological investigations have proved that several glands in the body pour out into the blood- or lymph-vessels ferments or substances which perform definite physiological functions in the system. Disease of these glands perverts these functions, and secondary disorders follow. Acting upon the discoveries just named, some persons have attempted to show that nearly all of the organs of the body, be they glands or not, possess these functions, until they have reached a *reductio ad absurdum.* On the other hand, some of the glands are now used, when derived from the lower animals, for definite therapeutic purposes, such as the thyroid gland and the suprarenal bodies, for example. The use of these glands will be found discussed under their own names, but unimportant glands in therapy, or those in regard to which doubt exists, are included under the general heading here given. (See Thyroid Gland, Pituitary, and Suprarenal Gland.)

The employment of testicular juice, or the dried gland itself, has been practically abandoned, but the dried corpus luteum seems to possess considerable power. (See Ovarian Extract and Corpus Luteum.) It has been used to combat the symptoms following double oöphorectomy and those common to the menopause, and also for aphrodisiac purposes. On the ground that *chlorosis* is due to a faulty internal secretion of the ovary, it has been given in this condition with asserted good results, and also in *osteomalacia, neurasthenia,* and *hysteria* in females. The dose is from 2 to 4 grains (0.1–0.2) three times a day. (See Corpus Luteum.)

The use of cerebral and spinal extracts has proved futile, as has also the use of bone-marrow in *pernicious anemia.* Liver, or its extract, is given in the dose of 3 ounces (90.0) of fresh gland a day to combat the *delirium of cirrhosis,* with asserted good results (Carnot), and has been thought to do good in *alcoholic cirrhosis with icterus,* in that the *hemorrhages* were arrested, the delirium ceased, and the patient generally improved. The same treatment has been tried in *diabetes.* The use of liver is essential in *pernicious anemia.* (See Anemia Part IV for details as to liver in pernicious anemia.)

While glandular therapeutics gives promise of aiding greatly in the treatment of disease, and while for this reason the cautious physician should not oppose resort to the use of glandular extracts, he should, nevertheless, always study the physiological function of the gland to be employed in order that he may reach a clear idea of its remedial possibilities. The extraordinary effects of some glands do not prove that all animal extracts are of value, nor does the failure of others indicate that all are useless.

GLUCOSE.

(SEE DEXTROSE).

GLYCERIN.

Glycerinum, U. S. and B. P., sometimes called glycerol, is a liquid obtained by the decomposition and distillation of fats. It is a clear, colorless liquid, of a syrupy consistence, smooth to the touch, odorless and sweet to the taste. When exposed to the air it absorbs moisture. It is soluble in all proportions in water and alcohol.

An aqueous solution of glycerin is neutral to litmus paper.

Physiological Action.—Injected into the circulation in large amounts, glycerin causes convulsions, which are due to its hygroscopic power. Even if pure it irritates the skin of susceptible persons when applied locally, by its absorption of water, and often causes a slight rash.

Therapeutics.—According to the clinical researches of Pavy, glycerin increases the polyuria of diabetes almost one-half, and for this reason he thinks it is not to be employed in this class of cases as a substitute for sugar. Other clinicians, however, have disagreed with him and use it constantly for this purpose with asserted advantage, but saccharin has largely supplanted it. Glycerin may, therefore, be employed as a sweetening agent in the food of *diabetics* and in cases where sugar cannot be used, but a more important use is its employment as an antiketogenic agent, since it has a caloric value about that of starch. Only a small percentage is converted into sugar, the remainder seeming to have a definite effect in preventing the formation of ketone bodies. The dose is usually about 1 ounce (30.0) a day. Its chief field of usefulness is in those patients whose carbohydrate tolerance is quite low. It has also been given as a laxative in 1- to 2-dram (4.0-8.0) doses by the mouth or by rectum—1 to 4 drams (4.0-16.0) with or without equal parts of water. (See Magnesium Sulphate.) In some cases it may be used in suppository in the official *Suppositoria Glycerini,* U. S. and B. P. This latter method is very successful in *chronic constipation.* Its continued use by suppository may, however, result in rectal irritation.

As an antiseptic it is used for preserving specimens and for keeping alkaloids in solution for hypodermic use.

In *acute coryza,* applied by a spray or brush to the nostrils, it is sometimes of service; for this purpose it should be diluted four or five times with water. If used on the skin, it should be diluted one-half with water. In cases of *impacted cerumen* in the external auditory canal glycerin is often of service in softening the mass.

The uses of glycerin, other than those mentioned, are many. In the proportion of equal parts of glycerin and water it makes a very useful mouth-wash for the *sore* and *dry mouth of typhoid fever* and for the removal of *sordes.* The same wash, with lemon-juice added to it, is very agreeable and will relieve the dry, glazed tongue of advanced *phthisis.*

Owing to the fact that glycerin is hygroscopic, it may be used as a depletant on a pledget of cotton in *congestion of the uterine cervix,* the tampon being renewed daily.

For the prevention of *bed-sores* Ringer recommends the daily washing and rubbing of the part likely to be affected, followed by the application of glycerin and water, with a draw-sheet placed smoothly against the patient to protect the bedding.

Glycerin and whisky is a favorite household remedy for *colds* and *coughs,* but is not very useful. Glycerite of starch (*Glyceritum Amyli,* U. S.; *Glycerinum Amyli,* B. P.) is used as a protective over superficial irritations of the skin. Glycerite of yolk of egg (*Glyceritum Vitelli*) is used in making emulsions.

A very useful ointment for the application of medicinal substances to the skin may be made by constantly mixing in the presence of heat 1 part of potato starch and 15 parts of pure glycerin. The result is a clear, transparent, jelly-like substance which does not decompose, and has the advantage of holding the medicament which it carries in solution rather than by mechanical suspension.

The B. P. preparations of glycerin are as follows: *Glycerinum Acidi Carbolici, Glycerinum Acidi Tannici, Glycerinum Aluminis, Glycerinum Acidi Borici, Glycerinum Plumbi Subacetatis, Glycerinum Tragacanthæ, Glycerinum Boracis, Glycerinum Pepsini, Glycerinum Amyli,* and *Unguentum Glycerini Plumbi Subacetatis.*

GLYCERITE OF BOROGLYCERIN.

The glycerite of boroglycerin (*Glyceritum Boroglycerini,* U. S.) is made by adding glycerin to boroglycerin.

Locally the glycerite of boroglycerin is used as an antiseptic and as a vehicle for phenol, chrysarobin, and the vegetable alkaloids in the treatment of skin diseases, and in diseases of the eye, such as *purulent ophthalmia.* It is also used on vaginal tampons to deplete the surrounding tissues and applied by means of a tampon to the uterine cervix will often stop the *vomiting of pregnancy.*

GRINDELIA ROBUSTA.

Physiological Action.—Upon the lower animals and man *Grindelia,* N. F., is not very powerful in its action, but may cause, in large doses, paralysis of the peripheral sensory nerves, the sensory centers in the spinal cord, and finally the motor centers and nerve trunks. It slows the heart by stimulating the vagi, and raises blood-pressure by stimulating the vasomotor center.

Therapeutics.—Grindelia robusta is a useful remedy in some cases of *asthma* and in *bronchitis* in its later stages. It may be given in the dose of 20 to 60 minims (1.3–4.0) of the fluidextract (*Fluidextractum Grindeliæ,* U. S.), or by inhaling the fumes of burning grindelia leaves, which have been previously soaked in a solution of nitre, dried, and burned on a plate or rolled into a cigarette and smoked. In *chronic cystitis* it stimulates the bladder and is of service. By diluting the fluidextract 1 to 10 with water it forms one of the best lotions that we have for the relief of the *dermatitis* produced by poison ivy, or *Rhus toxicodendron.*

Administration.—The fluidextract (*Fluidextractum Grindeliæ,* N. F.), dose 20 to 60 minims (1.3–4.0).

GUAIACOL.

Guaiacol (U. S. and B. P.) is a liquid constituting from 60 to 90 per cent of creosote. It is obtained by the distillation of beechwood creosote, followed by a complicated process which it is not necessary to describe. Much of the "absolute guaiacol" of commerce is impure. As it melts at 83.5° F., it usually is dispensed in a fluid form.

Therapeutics.—Guaiacol has been largely used by some practitioners, chiefly in Europe, in the treatment of *tuberculosis* as a substitute for creosote, because it is the principal ingredient of that drug. (See Creosote.) It was thought by Guttmann, Sommerbrodt, and others that the good effect of creosote was due to its destructive action on the bacillus, or that it so improved digestion as to indirectly increase the resistance of the patient to the spread of the disease. Hoelscher and Seifert have asserted that guaiacol and creosote produce their good effects by forming compounds with the toxins or poisonous albuminoids formed by the bacilli, which are then eliminated from the body. There is no proof of this.

The same rules govern the use of guaiacol as govern the employment of creosote. It is best given with brandy, wine, or other alcoholic drink, or in capsule with cod-liver oil or sweet oil. Five or 10 minims (0.3–0.6) of guaiacol may be added to a pitcher of hot water and the vapor inhaled three or four times a day in cases of *subacute* and *chronic bronchitis*. The dose by the stomach is 5 to 20 minims (0.3–1.3). In *acute follicular tonsillitis* pure guaiacol may be painted over the tonsils with advantage, but it is at first very painful.

Clinical observations prove conclusively that guaiacol possesses powerful *antipyretic* influences. As pointed out by Sciolla in 1893, guaiacol when painted on the skin of a febrile patient causes a pronounced fall of temperature, which begins soon after the application is made, but is not fully accomplished for from two to three hours. The application may be made to the skin of the abdomen, thighs, or chest, about 30 to 40 minims (2.0–2.6) being used with a brush. When a full effect is required, it is well to place an impermeable dressing over the part painted to prevent evaporation and aid absorption. These applications may be resorted to as often as is necessary for the reduction of the fever, and, although the fall of temperature is sometimes very rapid—as much as 7° F. in two hours—the late Prof. J. M. Da Costa asserted that he never had seen serious nervous or cardiac symptoms produced, but other observers have noted such untoward results. The temperature is very apt to rise speedily after the reduction, and this rise is often preceded by a chill. These applications cannot supplant the cold bath, although they undoubtedly do reduce the temperature. The true sphere of usefulness to be assigned to guaiacol as an antipyretic seems to be that of a far less valuable therapeutic measure than the bath, and one equally powerful and about as dangerous as are the antipyretic drugs of coal-tar derivation.

The studies of Stolzenberg show that if frequently and constantly used guaiacol produces in febrile patients a tendency toward depression. Thayer found that great sweating and depression generally follow its external use in fevers. Future reports will probably develop the fact that in cases of renal irritation guaiacol will prove harmful.

Guaiacol has been used by painting it on the affected part in the treatment of superficial *neuralgias*, and in deep-seated *nerve pains*, as in sciatica, it has been given hypodermically, in the dose of 2 minims in 10 minims of spirit of chloroform, injected deeply into the neighborhood of the painful nerve. This is dangerous.

If guaiacol is placed upon the skin by means of a small compress, which has been wet with it and bound tightly to the part, local anesthesia is rapidly developed; but if left in place too long, it may be absorbed in sufficient amount to cause depression or a fall of temperature.

Belfield highly recommends painting the scrotum with guaiacol 15 minims (1.0) and glycerin 45 minims (3.0) for *orchitis*, or an ointment of guaiacol 1 dram (4.0) to 4 drams (16.0) of lanolin may be rubbed into the scrotum and applied on lint. This should be applied every other day.

A serious objection to the external use of guaiacol is its disagreeable odor.

GUAIACOL CARBONATE.

Carbonate of guaiacol (*Guaiacolis Carbonas*, U. S. and B. P.) is a white crystalline powder, consisting of 91.5 per cent of pure guaiacol and 8.5 per cent of carbonic acid. This powder is insoluble in water, neutral in reaction and is said to be without irritating effect on the stomach. Taken by the healthy individual, it is decomposed into guaiacol and carbonic acid in the bowel, but not in the stomach, and it is used for this reason, as salol is, as an intestinal antiseptic, in the various forms of *fermentative diarrhea* and *typhoid fever*. The drug is said to be slowly absorbed, but after absorption is rapidly eliminated. Its therapeutic applications in *tuberculosis* are practically identical with those of pure guaiacol, save that it is more readily borne by the stomach than the latter drug. Guaiacol carbonate may be given in capsule or pill, or it may be given in dry powder on the tongue in the dose of 2 to 10 grains (0.12–0.6). Usually in *typhoid fever* the dose is about 2 grains (0.12) every three hours, and in *tuberculosis of the lungs* 5 grains (0.3) three times a day.

HÆMATOXYLON.

Hæmatoxylon, *Hæmatoxyli Lignum*, B. P., or logwood, is the heartwood of *Hæmatoxylon campechianum*, a tree of the American tropics. It contains an active principle, hæmatoxylin.

Therapeutics.—Hæmatoxylon is a mild astringent very useful in *serous diarrheas* and the diarrheas of young children as children do not dislike it, owing to its agreeable taste. (See article on Diarrhea.) As it colors the stools and urine red, the nurse should be warned lest she be alarmed at the sight of what looks like blood on the diaper after the drug is given to infants. If the urine is alkaline, the color may be violet or red. In *leucorrhea* its internal use is said to be of service. The extract (*Extractum Hæmatoxyli*) is given in the dose of 8 to 30 grains (0.5–2.0), and *Decoctum Hæmatoxyli*, B. P., in the dose of 1 to 2 fluidounces (30.0–60.0). An unofficial fluidextract is often to be found in the shops. The dose of this is ½ to 2 fluidrams (2.0-8.0). (See article on Diarrhea.)

HAMAMELIS.

Hamamelidis Cortex and *Hamamelidis Folia*, B. P., witch-hazel, or *Hamamelis virginiana*, is a plant of the United States, devoid of any active principle, but possessing considerable remedial power.

Therapeutics.—Hamamelis is to be employed in *relaxed sore-throat* resulting in congestion and hyperemia following exposure or where mild catarrhal states are present. Similarly, it is employed in an atomizer, after attacks of acute coryza, to tone up the nasal mucous membrane. The strength of the solution should be 20 to 60 minims (1.3–4.0) of the distilled extract to the ounce (30.0) of water. Hamamelis when taken internally is often very successful in the treatment of *uterine oozing* from small bloodvessels, seems to do good even in *hematemesis*, and will sometimes arrest *hematuria* when other remedies fail. Applied by means of cloths to recent *leg ulcers*, it rapidly relieves the angry-looking skin surrounding the ulcer. The limb should be elevated and at rest while the treatment is pursued. In *bleeding from the bladder* it may be injected into this viscus daily in the form of the distilled fluidextract. Taken internally and applied locally, it is of value in the treatment of *bleeding* and the so-called *blind piles*. (See Hemorrhoids.)

Administration.—The distilled extract (*Aqua Hamamelidis*), which is no longer official but is in the N. F., is a perfectly clear fluid, given in the dose of from 30 minims to 1 dram (2.0 4.0). It is much the best preparation for internal and external use. The B. P. recognizes a solution, *Liquor Hamamelidis*, *Tinctura Hamamelidis* and *Unguentum Hamamelidis* and *Extractum Hamamelidis Liquidum*.

HEROIN.

Heroin (*Diacetylmorphinæ Hydrochloridum; Diamorphinæ Hydrochloridum*, B. P.) is a white crystalline powder without odor and possessing a slightly bitter taste. A group of persons more interested in the protection of addicts than in the welfare of a multitude of worthy sick have gotten a bill through Congress whereby this drug can no longer be made in or imported into the United States. It is used in medicine for the purpose of controlling *excessive cough* and relief of postoperative pain. Under its influence the respirations are usually slightly slowed and deepened. At one time it was thought to be less depressant to the respiratory center than morphine, and even stimulant in its influence, but Cushny has shown that it is a more powerful respiratory depressant than morphine. The dose is $\frac{1}{20}$ to $\frac{1}{6}$ grain (0.003–0.01), three times a day. Large doses do not act as well as small ones as a rule. It is said to be of value in *uremic dyspnea.* The fact that it does not stupefy the patient nor produce constipation is strongly in its favor. As heroin is insoluble, *hydrochloride of heroin* is the preparation used for watery solutions; or heroin itself may be dissolved in water to which a little acetic acid has been added. It may also be given in pill or powder with white sugar. Tablets of heroin may turn brown with age. This is due to a slight excess of acid which renders the drug more soluble but caramelizes the sugar in the tablet. Like all derivatives of opium its repeated use may develop a habit.

HEXAMETHYLENAMINE.

(See Methenamine, U. S.)

HEXYLRESORCINOL.

Resorcinol is a relatively feeble germicide, but by the introduction of the hexyl group it becomes many times more efficient than phenol, so that its germicidal power is increased 150 times. It is claimed that it passes through the stomach and is absorbed from the small intestine, being promptly eliminated by the kidneys, and that adequate doses do not produce irritation of those organs, although if it is taken on an empty stomach it may cause distress. Its power as a urinary disinfectant is chiefly exercised upon cocci. It seems to be much less efficient in the presence of bacillary infection. The drug acts equally well in acid and alkaline urine, but sodium bicarbonate is not to be given with it as for some unknown reason, it seems to diminish the activity of hexylresorcinol. Water should not be taken freely as it dilutes the drug in the urine.

Hexylresorcinol appears on the market in capsules after being dissolved in olive oil in the proportion of 25 per cent, the quantity of the drug in each capsule being 0.15 gram. The dose for an adult is 2 to 3 capsules after meals three times a day, and, if need be, 3 capsules three times a day. These doses sometimes cause diarrhea, but it is asserted that this symptom is usually relieved by omitting a few doses. In children the dose is 1 capsule three times a day. The drug is also prepared for children dissolved in olive oil 2.5 per cent. The dose is 1 to 2 drams (4.0–8.0). The use of the drug has usually to be maintained for several weeks or months before cure and avoidance of relapses is obtained. Cases have been reported in which marked gastro-intestinal disturbances and hematuria have occurred.

Hexylresorcinol Solution, S. T. 37.

This is a preparation which it is claimed will destroy all ordinary pathogenic organisms in fifteen seconds and consists of a 1 to 1000 solution of hexylresorcinol in 30 per cent glycerin and 70 per cent of water. Because of its great penetrating power, due to its low surface tension, it is used in full strength as an efficient antiseptic in cleaning fresh cuts and for washing out *infected wounds* and *abscesses*. Although not irritating it is diluted up to five times with water for douches and sprays or wet packs.

When applied to a wound or burn it not only exercises a penetrating effect but checks secretion or exudation so that the surface becomes devoid of moisture.

The letters and figures S. T. 37 stand for surface tension 37 dynes per cubic centimeter. Ordinary fluids have a far higher surface tension and it is this low tension which causes the drug to penetrate the body of the parasite.

HOFFMANN'S ANODYNE.

Spiritus Ætheris Compositus, B. P., consists of alcohol, ether, and the heavy oil of wine. It is no longer official in the U. S. P., but is largely used. The writer has experimentally studied very thoroughly the action of the last-named ingredient, and finds:

First. That the belief in heavy oil of wine being the quieting agent in Hoffmann's anodyne is fallacious.

Second. The calmative effects of this mixture depend largely on the ether, rather than on the oil.

Therapeutics.—Hoffmann's anodyne is the best carminative that we possess for general use, and is one of the best remedies for *singultus* or *hiccough*. This effect is accomplished by the alcohol and ether acting as irritants or stimulants to the stomach and intestine, so that free peristalsis results. In *angina pectoris* this drug is often the best remedy we have during the attack. In the cardiac palpitation of *tobacco-heart* or in that arising from indigestion and in the nausea and depression seen after excessive smoking it is also very useful.

In sudden *collapse* in infants the following may be used with advantage:

℞—Spiritus ætheris compositi,
Spiritus ammoniæ aromatici,
Tincturæ aurantii . . . . āā ♏x (0.65)
Aquæ camphoræ . . . . f ʒj (4.0).—M.
S.—Give at one dose in a little water.

Hoffmann's anodyne should always be given in capsule or in cold water, preferably ice-cold, in order to prevent too rapid volatilization of the ether and consequent difficulty in swallowing the liquid.

The dose is 1 to 2 drams (4.0–8.0) to an adult. The vapor of the ether is so irritating that the drug is difficult of administration to very young children.

HOLOCAINE.

Holocaine is a synthetic substance, allied to phenacetine, which is almost insoluble in cold water, and which is therefore commonly employed in the form of the soluble hydrochloride. This salt is a white crystalline body, which is stable when brought in contact with many agents, but is readily decomposed by alkalies. Solutions of this preparation possess distinct antiseptic power, and therefore do not require boiling in order that they may be sterile. As the drug when in solution gradually loses its anesthetic power, it should be freshly dissolved when it is needed or at least not kept in solution over a week. It is also called phenacaine.

Holocaine is used as a local anesthetic for the eye in place of cocaine, usually in the strength of 1 per cent. When so employed its primary effect is to produce a sharp stinging sensation which soon passes off. Its anesthetic effect begin in about fifteen seconds to one minute, and last about five to fifteen minutes. It does not dilate the pupil as does cocaine, nor does it affect intra-ocular tension or roughen the corneal epithelium. Holocaine has not supplanted cocaine, but, for the reason just given, is useful in cases requiring anesthesia and yet at the same time suffering from *keratitis* or *iritis*. It does not cause primary ischemia or secondary hyperemia of the mucous membrane as does cocaine.

HOMATROPINE.

Homatropine is an artificial alkaloid. The hydrobromide of homoatropine (*Homatropinæ Hydrobromidum*, U. S. and B. P.) is a crystallizable salt of homatropine, soluble in 5.7 parts of distilled water. The B. P. recognizes discs of homatropine (*Lamellæ Homatropinæ*).

Hydrobromide of homatropine, properly applied by frequent instillations, is a reliable mydriatic when it is desired to correct anomalies of refraction in healthy eyes. Experience is not at hand to determine its value for this purpose in eyes affected with retinal-choroidal disturbance. Atropine and hyoscyamine are preferred under such circumstances, for the obvious reason that their prolonged action is desirable as a method of treatment. The danger of systemic disturbance from homatropine is remote, even when repeated instillations have been made, and its temporary action upon the pulse causes no inconvenience to the patient. Slight hyperemia of the conjunctiva almost invariably follows its use, but true conjunctivitis, if it occurs at all, must be exceedingly rare. According to the studies of de Schweinitz and the writer, the drug has a physiological action closely allied to that of atropine, from which it is derived. Homatropine mydriasis generally lasts from thirty-six to forty-eight hours, that of hyoscyamine eight to nine days, and that of atropine ten to twelve days. For the production of ordinary mydriasis the drug should be used in solution of the strength of 4 grains (0.25) to the ounce (30.0) of distilled water, which is to be dropped into the eye every five or ten minutes. As the drug is expensive only a few drams of the solution of the strength named should be ordered for a patient.

HOPE'S CAMPHOR MIXTURE.

This is a mixture originally made with nitrous acid, but largely used at present with nitric acid, owing to the fact that nitrous acid is changed into nitric acid when water is added to it. The nitrous acid is, however, more efficacious than nitric acid in the *serous* or *choleraic diarrheas* which it is used to combat. The formula is as follows:

℞—Acidi nitrosi	f ʒj (4.0)
Aquæ camphoræ	f ℥viij (240.0)
Et adde:	
Tincturæ opii	gtt. xl (2 6).—M.

S.—One-fourth of this in water every three or four hours.

HYDRASTIS.

Hydrastis, U. S., or *Hydrastis Rhizoma*, B. P., sometimes called golden seal, contains two alkaloids known as hydrastine and berberine, and perhaps xanthopuccin.

Physiological Action.—When given to one of the lower animals in poisonous doses hydrastis may cause spinal convulsions followed by paralysis, according to the quantity of berberine or hydrastine present. The latter is more convulsive in its effects than the former. Upon the circulation hydrastine, when injected into the jugular vein, causes a primary fall of arterial pressure, succeeded by a decided rise, and the studies of Cerna have proved that it is an active poison. When given to man in medicinal amounts its effect on vital functions is very slight indeed.

Therapeutics.—Hydrastis is of service in *chronic gastro-intestinal catarrh*, particularly that following the abuse of alcohol, and may be used as a stomachic and tonic after malarial fever and similar depressing diseases. Wherever mucous membranes are in a condition of lowered tone this drug is indicated.

One of the best remedial measures that we have in the later stages of *gonorrhea*, when the acute period has passed, is the local and internal use of hydrastis. If it is used as an injection, 5 grains (0.3) of the commercial hydrastine to each ounce (30.0) of water should be employed twice a day. Belfield has highly recommended the following formula for use in this disease prior to the tenth day:

℞—Hydrastinæ hydrochloridi . . . . gr. v (0.3)
Protargol . . . . gr. v (0.3)
Glycerini . . . . fʒss (2.0)
Aquæ destillatæ . . . . q. s. ad f℥j (30.0).—M.

S.—Precede with a hot-water injection and use four to six times daily, telling the patient to retain it five to ten minutes each time.

The following infusion will be found of service in *vaginal gonorrhea* and *leucorrhea:* Take 1 dram of the powdered root and add it to 8 ounces of boiling water; ½ to 1 dram of the fluidextract may also be added to a pint of water and used as a douche.

Administration.—The fluidextract (*Fluidextractum Hydrastis,* U. S.; *Extractum Hydrastis Liquidum,* B. P.) may be given in the dose of of 5 to 30 minims (0.3–2.0). The dose of the tincture (*Tinctura Hydrastis,* B. P.) is from 30 minims to 2 drams (2.0–8.0). The *Glyceritum Hydrastis* is used as a healing application to mucous membranes. *Extractum Hydrastis,* N. F., is given in the dose of 1 grain (0.06).

Much doubt exists as to the dose of hydrastine. This arises from the fact that two forms of it are sold. That most commonly seen is a dark brown mass which is very impure, and contains berberine and other substances. Its dose of this is 3 to 10 grains (0.2–0.6). The pure hydrastine (not official), as made by Merck, is given in the dose of ¼ to ½ grain (0.015-0.03). Hydrastinine hydrochloride (*Hydrastininæ Hydrochloridum*) is an artificial alkaloid of hydrastine dose ½ to 1 grain (0.03–0.06).

HYDRIODIC ACID.

Acidum Hydriodicum Dilutum (U. S. and B. P.) is a solution of hydriodic acid containing about 10 per cent of absolute acid and about 90 per cent of water.

Its physiological and therapeutic action is practically identical with the other iodides (which see). The dose is 5 to 40 minims (0.3–2.6), well diluted with water.

The syrup of hydriodic acid (*Syrupus Acidi Hydriodici,* U. S. and B. P.), the preparation always used, is an efficient substitute for the other iodides when moderate doses are required. If discolored it should be discarded. The dose is from 1 to 4 drams (4.0–16.0), well diluted with water, and taken one hour after meals.

HYDROBROMIC ACID.

(See BROMIDES.)

HYDROCHLORIC ACID.

Acidum Hydrochloricum (U. S. and B. P.) is a clear, colorless liquid. In the strength of 0.2 per cent it is normally present in the gastric juice, and aids the pepsin in the conversion of proteins into peptones and in the formation of pepsin from pepsinogen.

Therapeutics.—Hydrochloric acid is indicated only in certain forms of *indigestion.* With new methods of studying gastric secretions we have learned that it is of value in those cases in which the gastric secretion of HCl is deficient. Thus it is given to aid digestion during and after fevers, when this acid is apt to be absent from the gastric juice, particularly in *typhoid fever.* In cases of *gastric cancer,* when this acid is usually absent from the gastric secretion, and in the *sick stomach* following an alcoholic debauch, it is of great service. In some cases of *chronic gastric catarrh with dilatation,* in which there is atrophy of the gastric tubules and in *pernicious anemia* (see Anemia, Part IV), it should be used freely. The dose of the dilute acid (*Acidum Hydrochloricum Dilutum,* U. S. and B. P.) is 5 to 20 minims (0.30–1.3). (See Indigestion, Part IV.)

A useful prescription in such cases is:

℞—Acidi hydrochlorici diluti	f ʒij (8.0)
Essentiæ pepsini	f ℥j (30.0)
Tincturæ gentianæ compositæ . . . q. s. ad	f ℥iv (120.0).—M.

S.—Dessertspoonful (8.0) in a little water with meals.

This acid is combined with nitric acid to form dilute nitro-hydrochloric acid (*Acidum Nitro-hydrochloricum Dilutum,* N. F. and B. P.) the dose of which is 10 to 30 minims (0.6–2.0), 5 to 20 minims (0.3–1.3), B. P.; also the pure acid (*Acidum Nitro-hydrochloricum,* N. F.), dose 1 to 5 minims (0 05–0.3).

Hydrochloric acid causes, when taken in poisonous doses, violent *gastro-enteritis* and corrosion of the gastric walls, and its action should be combated by alkalies, soap, oils, and white of egg, and the use of opium to relieve pain and irritation.

HYDROCYANIC ACID.

Hydrocyanic or Prussic Acid is a transparent, colorless, very volatile liquid, giving rise to vertigo when inhaled in minute amounts and capable of producing death if the fumes be concentrated. If the bottle containing the pure drug be opened, it should be done where there is sufficient draught between windows to prevent any contamination of the atmosphere of the room by the acid.

Pure hydrocyanic acid is never used in medicine; the form employed is the dilute acid (*Acidum Hydrocyanicum Dilutum,* B. P.), which contains about 2 per cent of the drug in water. It is no longer official.

Physiological Action.—This is one of the most rapid (if not the most rapid) of the lethal poisons, only being approached by carbolic acid and nitrobenzole in the violence of its effects. Owing to its volatility, it is absorbed with great rapidity, and acts upon the respiratory center and the heart, being eliminated almost immediately afterward. Because of its fleeting character, the survival of a patient twenty or thirty minutes after the ingestion of a poisonous dose is a favorable sign for his recovery.

The drug is an active paralyzant and exerts a lethal influence over every part of the body. The nervous system, heart, respiration, brain, and all vital parts are killed at once if much of it is present.

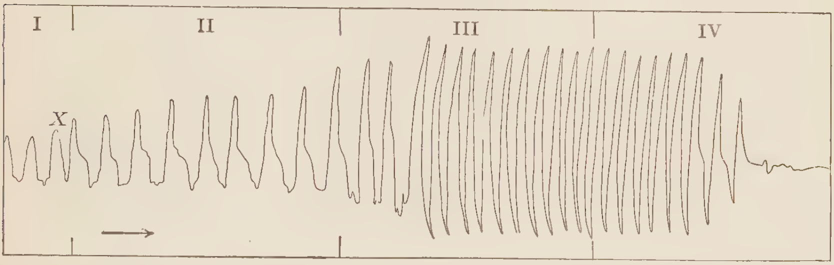

FIG. 52.—Tracing of the deep stormy respirations of an animal under the influence of hydrocyanic acid. (After Schmiedeberg.) *I*, normal respirations; *II*, acid inhaled; *III*, violent deep respirations; *IV*, arrest of respiration.

Poisoning.—When a lethal dose of hydrocyanic acid is taken, death either comes at once, so that the person drops with a gasp, is for a moment convulsed, the face cyanotic, the eyes wide open, with the teeth tightly clenched, and the lips covered by a bloody froth, or three stages of poisoning may ensue if the dose has not been large enough to result in immediate death, owing to its slow absorption. In the first of these stages there are difficult respiration, slow cardiac action, and disturbed cerebration. In the second stage, which is convulsive, there are present wild cries, dilated pupils, unconsciousness, vomiting, spasmodic urination and defecation, erections of the penis, and ejaculations of semen. In the third stage there are asphyxia, collapse, and paralysis ending in death. The blood is found to be dark and venous-looking, but does not give the spectrum bands of cyanohemoglobin. These bands only appear when the drug is shaken with blood outside the body.

The diagnostic signs of death from prussic acid are the odor of the acid about the body, the wide-staring eye, the clenched teeth covered with froth, and the livid, cyanosed face. If the body be opened, the odor of hydrocyanic acid is marked, but this rapidly passes away owing to the volatility of the drug.

The only poison producing symptoms resembling those which have just been described is nitrobenzole, or essence of mirbane, which has a somewhat similar odor, but which is, however, more permanent, the odor remaining for hours in the opened body.

Therapeutics.—Hydrocyanic acid is used in cases of *gastralgia* of purely nervous origin, in some cases of *nervous vomiting,* and in *irritable stomach,* where owing to hyperesthesia of the mucous membranes, the taking of food produces discomfort.

In *irritable coughs,* due to tickling in the throat it has been very extensively used, and has received high praise by those best qualified to judge. On the other hand, it has been claimed that owing to the extreme volatility of the drug it acts only for the moment, and that a dose every ten or fifteen minutes is necessary to produce any constant effect. However this may be in theory, practically the acid certainly does aid in relieving cough. In these states the following prescription will be found of service:

℞—Acidi hydrocyanici diluti	fʒj (4.0)
Syrupi pruni virginianæ	f℥iij (90.0).—M.

S.—Teaspoonful (4.0) every four or five hours to an adult.

Externally, the drug is useful in *pruritus* and other forms of *itching skin diseases,* and the following formula will be found of service in *pruritus vulvæ:*

℞—Hydrargyri chloridi corrosivi	gr. iss (0.09)
Acidi hydrocyanici diluti	fʒj (4.0)
Aquæ amygdalæ amaræ	f℥vj (180.0).—M.

S.—Poison! For external use. Apply to the itching surface with a small rag.

The same prescription may also be employed in pruritus without the bichloride, if so desired. The dose of dilute hydrocyanic acid is 1 to 5 minims (0.05–0.3).

HYDROGEN PEROXIDE.

Peroxide of hydrogen is a clear, odorless, syrupy fluid of a specific gravity of 1.452, possessing a harsh, bitter taste. It is readily soluble in water, and its chemical formula is H_2O_2. Pure peroxide of hydrogen is never used in medicine, but in solutions of varying strength. The ordinary solution, as found in the shops and that now official (*Liquor Hydrogenii Dioxidi,* U. S., *Liquor Hydrogenii Peroxidi,* B. P.), is a slightly acid aqueous solution of hydrogen dioxide, which should contain, when freshly prepared, about 3 per cent, by weight of absolute hydrogen dioxide, corresponding to about 10 volumes of available oxygen. It should be kept in a cool place. It is a colorless liquid, liable to deteriorate upon keeping or on protracted agitation, without odor, slightly acidulous to the taste and producing a peculiar sensation and soapy froth in the mouth. If the stopper in the bottle be replaced by a pledget of cotton deterioration is retarded. When exposed to the air at the ordinary temperature, or when heated on a water-bath at a temperature not exceeding 60° C. (140° F.) the solution loses chiefly water. The term "10 volumes" signifies that it can yield 10 volumes of available oxygen, and it is upon this yield of oxygen that its activity depends. The acid reaction is due to a small amount of acid added to the solution to preserve it. This can be neutralized by the addition of a little sodium bicarbonate just before it is used.

Marshall has proved that the constituent of blood and pus that sets free the oxygen from this drug is globulin.

Therapeutics.—The most valuable use of the peroxide of hydrogen solution in medicine is in the treatment of *diphtheria.* So far as we know, it is the best application for the destruction and removal of the false membrane. There is no injury to the normal tissues nor is there the danger of poisoning which sometimes follows the use of such drugs as carbolic acid. Applied to the false membrane, there is at once an active effervescence with some local tingling of the part. The membrane can afterward be removed in shreds. The solution should be applied by means of a swab or spray, but if the latter is used a glass atomizer must be employed, as the peroxide is decomposed by coming in contact with metals. Peroxide of hydrogen is also a very valuable application for cases of *follicular tonsillitis* with profuse exudation, to cleanse the parts prior to the use of guaiacol. (See Guaiacol.)

In the treatment of *abscess cavities,* tubercular or septic in character, the peroxide of hydrogen is a very valuable application, and its use will often decide the presence of pus, since when it meets with this material active effervescence ensues; but care must be exercised that free vent is allowed for the gas that is given off, as if confined it will force the septic material into the surrounding healthy tissues. Similarly, it is a valuable preparation for cleansing *infected wounds, ulcers,* and *malignant growths* which have ulcerated. So too it may be used with soap and water to disinfect or sterilize the hands. When the hands are thoroughly soaped a little peroxide is poured into the palms when a profuse lather is formed. This is well scrubbed into the skin and under the nails, washed off and the process is repeated twice when the lather is washed off with the peroxide and then rinsed in sterile water and dried with a sterile towel.

Hydrogen peroxide is a useful agent for the removal of *powder stains* in recent cases.

It is stated that the application of this liquid to the spot affected by a *hornet's sting* will give instant relief; and applied by means of an atomizer it is the best fluid to aid in the *painless removal of adhesive strips.* The part of the strip next to the skin should be sprayed as it is gradually pulled off. It is also used on plaster-of-Paris dressings to soften the material so that it can be cut with a knife or shears.

Where the peroxide is used as a gargle or mouth-wash it may produce pain through its attacking cavities in the teeth or the metallic substances with which they are filled. When so used it should always be diluted, 1 part to 3 of water.

The employment of the peroxide internally, with the idea that it will yield oxygen to the body in cases in which this gas is lacking in the blood, is futile. Even if the oxygen entered the blood, the amount disengaged from a possible dose would be too small to be of value.

Taken internally the peroxide of hydrogen is not poisonous. The internal dose of the *Liquor Hydrogenii Dioxidi* of the U. S. P. is from 1 to 4 drams (4.0–16.0), well diluted with water, and taken from a porcelain, not a metal, cup or spoon. It possesses no distinct value in internal medication.

HYOSCYAMUS.

Hyoscyamus, U. S., or henbane, is the dried leaves and flowers of *Hyoscyamus niger*. The leaves contain two alkaloids—one known as hyoscyamine, the other as hyoscine. (See Hyoscine.) The first has practically the same physiological action as atropine, save that it is more sedative in its effects on the nervous system. (See Belladonna.) The second is quite different in its influence over the body. Owing to the presence of hyoscine in hyoscyamus, it is more quieting and depressing to the nervous system than is belladonna. The only marked difference in the action of hyoscyamine and atropine upon the eye is in the period of mydriasis produced by each. While that of atropine lasts in man from twelve to fourteen days, hyoscyamine generally remains for only seven to nine days. Sometimes the development of mydriasis is preceded by violent pain in the eye due to a cramp of the ciliary muscle. If so, the drug must be pushed to overcome the spasm, but the physician must be sure that the condition is truly iritis and not glaucoma. The strength of the solution to be used is 2 grains (0.12) to the ounce (30.0).

Therapeutics.—Hyoscyamus is used in every condition indicating the employment of belladonna; or, in other words, wherever *local spasm* or *arterial relaxation* exists or where pain is due to *spasm*. It has been particularly recommended in *nervous cough*, in *whooping cough*, and in *colic*, and probably is better in its influences in these states than is belladonna. In combination with nitrate of silver the extract may be used with advantage in *chronic gastric catarrh* and *gastric ulcer*. In *urinary incontinence* due to *irritable bladder* it is very serviceable, and particularly, is this true of this affection in children and old persons, provided that the urine is first rendered normal by the use of acidifying drugs or by the use of alkalinizing drugs if it is abnormally acid.

Administration.—The drug itself is official in three forms and as hyoscyamine sulphate and hydrobromide. The dose of the tincture (*Tinctura Hyoscyami*, U. S. and B. P.) is 10 to 40 minims (0.6–2.6), $\frac{1}{2}$ to 1 fluidram (2.0–4.0), B. P.; the alcoholic extract (*Extractum Hyoscyami*, U. S. and B. P.), dose $\frac{1}{2}$ to 1 grain (0.03–0.06), 2 to 8 grains (0.12–0.48), B. P.; the alkaloid (*Hyoscyaminæ Hydrobromidum*, U. S.), dose $\frac{1}{60}$ to $\frac{1}{50}$ grain (0.001–0.0015), $\frac{1}{200}$ to $\frac{1}{100}$ grain (0.0003–0.0006), B. P.; the fluidextract (*Fluidextractum Hyoscyami*, U. S.) is given in the dose of from 2 to 10 minims (0.1–0.6).

Hyoscine.

This is one of the alkaloids derived from hyoscyamus, and is a thick syrupy substance which forms a crystalline salt with an acid. It has been largely supplanted by scopolamine, to which the name Hyoscine has been given. Although these alkaloids are chemically identical their therapeutic effect is different. Moir has shown clinically that the levulorotary hyoscine occurring in Nature is from fifteen to twenty times as powerful as dextrorotary hyoscine made artificially. He has also shown that if the levulorotary hyoscine is used for the production of twilight sleep that the infant is far more apt to suffer from apnea after its birth than if the dextrorotary hyoscine is employed, proving its potency. (See Scopolamine.)

Hyoscine is official in the form of *Scopolamine Hydrobromide* (*Scopolaminæ Hydrobromidum*, U. S. and B. P.).

Physiological Action.—Hyoscine quiets the cerebrum and produces deep sleep in a certain class of patients. In the lower animals and in man it may cause sleep or wild delirium. It causes loss of reflex action in overdose, which is due to depression of the spinal cord and not of the nerve trunks. Upon the circulation it has little effect, but it is worthy of note that it influences the vagus nerves, as does atropine, stimulating them at first, but finally depressing them, although the contrary has been asserted. In any event, the circulatory effect is a minor one.

In cases where hyoscine has acted in excess, or where an overdose has been given, pilocarpine may be used as a physiological antidote in full doses if the heart is sound.

Therapeutics.—Hyoscine is of value as a *hypnotic* in a very limited class of cases, and in this class generally acts most favorably. These cases consist of those who, from *acute mania*, *hysteria*, or similar cause, suffer from *insomnia*, and perhaps struggle violently against proper control or refuse to swallow or retain food.

The drug may be given to such persons hypodermically, in the dose of $\frac{1}{100}$ to $\frac{1}{90}$ grain (0.0006), or by the mouth in the dose of $\frac{1}{90}$ to $\frac{1}{80}$ grain (0.0008). The fact that it possesses no taste and is small in bulk renders it readily employed. In some persons it utterly fails, even in this particular type of case. In *delirium tremens* it may cause evidences of cerebral congestion and Cheyne-Stokes breathing, but, on the other hand, it very commonly aids in combating chronic *alcoholism* when given in repeated doses. (See below.) Some patients are not quieted by the drug, but pace up and down in a semi-sane condition until its action wears off. Such symptoms can generally be overcome by using larger doses or, better still, by using with it $\frac{1}{30}$ grain of apomorphine or $\frac{1}{4}$ grain of morphine. It does badly if the kidneys are diseased.

Hyoscine has been highly recommended in the treatment of the *morphine* and *alcohol habit*, and there can be no doubt that it is an excellent remedy. The patient must be under complete control and should be given enough hyoscine hypodermically to be thoroughly under its influence, as much as $\frac{1}{100}$ grain being given every two hours if need be to keep him quiet. Aside from constant quiet muttering and the characteristic delirium caused by the drug, no evil effects ensue and the patient usually, without much suffering, recovers from the effects of the narcotic drug to which he is a slave, and in a good general state so far as his nerves are concerned. (See Alcohol.)

Hyoscine is of great value in some cases of *spermatorrhea* and *nocturnal emissions* if given in the dose of $\frac{1}{100}$ grain (0.0006) at bedtime.

The drug is contraindicated in the sore-throat of scarlet fever, as it may cause a sensation of pharyngeal constriction. In the *insomnia of heart disease* with nervousness it may cause sleep, but often fails, and is not to be recommended.

Hyoscine is used by ophthalmic surgeons, and in the eye it is far less irritating than atropine. Indeed, it may be considered as being distinctly sedative in *plastic iritis.* Its effects are not, however, so lasting as are those of atropine; $\frac{1}{480}$ grain dropped into the eye in one dose produces mydriasis in eighteen minutes and ciliary paralysis in twenty-three minutes; this mydriasis lasts about twenty-two hours, and the ciliary paralysis about ninety-six hours (Oliver). It finds its greatest usefulness in the early stages of *iritis,* when a rapidly acting and efficient sedative mydriatic is demanded. Hyoscine is best used for this purpose in the strength of 0.2 per cent (1 to 500) in water. This solution may be dropped into the eye every twenty minutes until one hour has elapsed. As this use of the drug is slightly painful it is well to place a few drops of cocaine solution in the eye before each instillation of hyoscine. (For use in obstetrics see Scopolamine.)

ICHTHYOL.

The substance sold in the shops and employed in medicine under the name of ichthyol is a salt formed by the bibasic acid ichthyo-sulphuric or sulpho-ichthyolic acid with ammonium. In other words, it is ammonium ichthyol, which is a semi-solid substance. The ichthyo-sulphuric acid itself is derived from a crude oil, which in turn is obtained by destructive distillation from a deposit of fossil fish found in the Tyrol Mountains. When combined with sodium forming sodium ichthyol, a more solid substance than ammonium ichthyol is formed which can be employed if it is desired to use the drug in pill form. Both the ammonium and sodium ichthyol contain about 10 per cent of sulphur, and it is largely upon this that their therapeutic activity depends. They are both soluble in water, and have a dark brown, tarry appearance. Their disagreeable odor is due to an inseparable volatile oil. The stain produced by ichthyol is easily washed out of ordinary clothing except when it is mixed with vaseline, which, being insoluble in water, fixes the stain in the fabric.

Therapeutics.—Ichthyol is, without doubt, one of the most remarkable substances introduced for medicinal purposes within the last thirty years, both because of its curious origin and its therapeutic value in a large variety of ailments. In the author's hands it has proved most efficacious in the treatment of the inflamed areas in *acute articular rheumatism.* When used in this disease an ointment composed as follows is to be smeared over the inflamed part, and then spread on lint, which is wrapped about the limb:

℞—Ichthyolis	℥ss (16.0)
Olei citronellæ	gtt. xv vel xxx (1.0–2.0)
Adipis vel adipis lanæ hydrosi	℥j (30.0).—M.

This usually relieves the pain and tenderness of the part to a great extent. The same application, accompanied by rubbing or applying massage to the joint, is of value for the pain and stiffness met with after the acute manifestations of the disease have passed by.

The same prescription is also the best external treatment of *erysipelas* that we have. The skin should be carefully and gently washed, and then anointed with the ointment and covered by lint smeared with this ointment. If the disease be in the skin of the face, holes are to be cut in the lint for the mouth, nose, and eyes. Ichthyol is also a very useful drug in the treatment of *chronic skin diseases* associated with atony and induration of the deeper layers of the skin, such as *acne, eczema,* and *lupus* and *keloid* in their chronic stages. It is always better to use ichthyol in ointment form, but some practitioners have employed it by painting it on in watery solution with a camel's-hair brush. In *frost-bites, chilblains,* and in *burns* it is of service, and Agnew recommended it highly when rubbed into *lymphatic enlargements.* Ichthyol has proved remarkably efficacious in removing *peri-uterine* and other *pelvic exudations* when used as a salve with pelvic massage or in a vaginal suppository.

For *acute sprains,* and for the removal of the swelling following such injuries, its influence is extraordinary if it be well rubbed into the part affected.

In severe cases of *cracked nipples,* with much induration, an ointment of ichthyol, 1 to 4 drams (4.0–16.0) of lanolin, will prove of value, but it must be washed off thoroughly before each nursing or the child will not take the breast. Often the odor remains and prevents nursing.

The dose of ichthyol internally in *gastro-intestinal catarrh* is 1 to 10 grains (0.06–0.6), given in pill or capsule.

Ichthyol is a very useful remedy for the treatment of *fetid ozena.* (See Nasal Catarrah, Atrophic, Part IV.)

INSULIN.

For years it was believed by many physicians that some defect in the internal secretion of the pancreas was responsible for the glycosuria, and, indirectly, with the associated symptoms in diabetes. It has now been shown that the islands of Langerhans are the part of the pancreas governing the storage and utilization of carbohydrate in the body, and Banting and Best have isolated from these islands a substance to which the name Insulin has been given. This preparation has a very powerful influence upon the quantity of sugar in the blood, so powerful that if not used with caution so great a hypoglycemia may be induced as to sharply endanger the patient's life. This is called "insulin shock" which comes on suddenly, without dyspnea as in diabetic coma. In such a case the urine does not contain sugar, the patient is nervous, restless, has dilated pupils with profuse sweating and a sense of fear. The free use of orange juice or dextrose is essential. Even one dose may do this and the danger is greatly increased if the patient has not recently taken food. Insulin produces a state in which the blood sugar can be utilized, which results in a perfect combustion of fats and puts aside so-called acidosis, for "the fats are burned in the fire of the carbohydrates."

Insulin, per unit, is more efficient in lowering blood sugar when it is high than when it is low.

It is to be clearly understood that in a patient who has disease of the islands of Langerhans, resulting in *diabetes mellitus,* there is a necessity for the continuous use of insulin just as when hypothyroidism is present the constant use of thyroid gland is essential, *provided* that the glycosuria and hyperglycemia cannot be controlled by a maintenance diet.

It is also to be clearly understood that the use of insulin does not permit a free diet, but that the dietetic management of diabetes is absolutely essential. The point is that the physician must first determine the patient's carbohydrate tolerance and then raise it to a point as nearly normal as possible by the proper dose of insulin. To guard the patient properly he must be under constant observation and be the frequent subject not only of urinalysis, but of blood-sugar analysis as well. If because of isolation it is not possible to estimate blood sugar, the physician should never permit the urine of the patient to be entirely sugar-free if insulin is being used.

Although very remarkable effects for the better often follow the use of insulin, it is not to be forgotten that in some diabetics the changes induced in the tissues of the body by prolonged starvation and exposure to toxic agents has necessarily resulted in a general state which cannot be corrected even if the primary underlying cause of the disease is overcome by artificial means.

Insulin is measured in units, a unit being the least amount which will reduce the blood sugar of a 2-kilogram rabbit to 0.045 per cent after the animal has had no food for twenty-four hours. The number of units given once, twice or thrice a day depends on the severity of the patient's symptoms, objective and subjective, the object being to give that quantity which permits the patient to maintain the normal blood sugar of 0.08 per cent on a diet which is therefore adequate for his nutritive needs. (See Diabetes, Part IV.)

The dose may be started, after the patient's carbohydrate tolerance is determined, at 5 units hypodermically three times a day, one-half hour before meals. If a meal is omitted, or vomiting occurs, the dose of insulin should be omitted. It is well to recollect that a unit of insulin is capable of metabolizing a little less than 1.5 grams of sugar, and therefore if a man is passing 40 grams of sugar he may need about 29 units of insulin per day; but while it is true that 1 unit can utilize 1.5 grams of carbohydrate it is not always necessary to give quantity for quantity since much less insulin may, with proper diet, be sufficient to enable the body to carry on normally.

When a satisfactory balance between diet and the dosage of insulin is obtained the danger of so-called acidosis is put aside as are all the other symptoms due to the starvation of the patient by virtue of his inability to utilize carbohydrate. Insulin is singularly efficient in threatened *diabetic coma* and also after it develops. (See Diabetes, Part IV.) Should gangrene develop in a diabetic or any acute infection occur insulin with a free use of carbohydrate is essential.

It is wise in all cases to bear in mind that if during the use of insulin a sense of severe hunger, or a feeling of apprehension develops, or twitchings or convulsions ensue the remedy must be stopped, and easily absorbed carbohydrate, like dextrose or levulose, or orange juice, freely given, or death may ensue as the result of hypoglycemia. At the same time 10 to 15 minims (0.65–1.0) of adrenalin should be given hypodermically but pituitrin is not to be given if adrenalin is used as it prevents adrenalin from causing a rise in blood sugar. (Geiling.) On the other hand, Burn, Moebig and Ainslee have shown that the simultaneous use of pituitrin and insulin prevents insulin from causing a reduction in blood sugar. It is wise for the patient, if moving about, to carry some sugar in his pocket, to be swallowed at once if symptoms of hypoglycemia are threatened.

In threatened coma the dose may be 10 to 20 units every hour by hypodermic needle or, if coma is present 30 or 40 units every hour. There is no fixed dose. (See Diabetes, Part IV.)

Insulin is supplied in 5 cc. and 10 cc. vials, U-10, U-20, and U-40, containing 10, 20 and 40 units per cc., and in 10 cc. vials, containing 80 units per cc. The U-20 strength is most commonly used.

Insulin must be given hypodermically, as it is impotent when swallowed. The needle and syringe should be boiled to maintain asepsis and the water used must be "soft," that is distilled or rain water as "hard" water precipitates insulin. In coma it may be given very cautiously by a vein. The use of insulin with carbohydrate in cases of so-called *postoperative acidosis* and in *eclampsia* is a questionable practice unless a blood analysis reveals a hypoglycemia. In *postoperative acidosis* and *eclampsia* the ketosis is often due to damage of the liver cells which have usually been starved of glucose as have the muscles. There is little or no evidence that the body cannot utilize glucose in some of these cases if it can be gotten into the blood stream or that insulin aids a damaged liver in storing glucose as glycogen. On the contrary Dale has expressed the view that insulin restrains the conversion of glycogen in the liver into glucose. When glucose enters the circulation under ordinary circumstances it passes into the liver, is changed to glycogen and is stored as such. When sugar is needed the glycogen is once more changed back to glucose. We are not seeking in these cases to call into play the glycogenic function of the liver but to provide the body with glucose which it can use at once. When, however, there is definite ketosis, the CO_2 combining power dropping, it may be, in value below 15 volumes per cent, the use of dextrose and insulin is wise. Insulin in the proportion of 1 unit to each 5 grams of dextrose in 500 to 1000 cc. of salt solution is used to combat shock especially if the blood-pressure is very low. (See Dextrose, Part II, Intravenous Injection, Part III.)

IODALBIN.

Iodalbin is a new iodine preparation containing about 20 per cent of iodine, or, in other words, about 56 per cent less iodine than iodide of potassium. It is used for the same purposes as the latter drug. Owing to the readiness with which the iodine is absorbed, doses larger than those of iodide of potassium are usually not required, or, to express it differently, the iodine does not separate from the iodide of potassium, sodium, or ammonium as readily as it does from this combination of iodine with a proteid.

The minimum dose is 5 grains (0.3), repeated as frequently as may be needed.

IODIDE OF AMMONIUM.

(See Ammonium Iodide.)

IODIDE OF POTASSIUM.

Potassium iodide (*Potassii Iodidum*, U. S. and B. P.) should contain not less than 99 per cent of pure potassium iodide, and should be kept in well-stoppered bottles. It is very soluble in water.

It occurs in colorless transparent, translucent, or opaque white, cubical crystals, or a white, granular powder, having a peculiar faint, iodine-like odor, and a pungent, saline, afterward bitter taste. It is permanent in dry air, and but slightly deliquescent in moist air. It is soluble in 0.7 part of water, and in about 22 parts of alcohol at

25° C. (77° F.); in 0.5 part of boiling water, and in 8 parts of boiling alcohol; and in 2 parts of glycerin.

The physiological effects of potassium iodide are entirely comparable to those of iodine itself (see Iodine), but it is employed for somewhat different purposes, is less irritant, more readily given, and perhaps more readily absorbed. When it is given in very large doses or for a long period of time, the fact that the potassium base is a depressant poison is to be remembered, and it is well to use iodide of sodium instead. (See Sodium Iodide.)

Physiological Action.—CIRCULATION.—Upon this part of the system when in health iodide of potassium produces effects differing very slightly, if at all, from those caused by potassium itself. Small amounts raise the blood-pressure, and large quantities lower it (Provost and Binet), but if spasm and fibrosis of the bloodvessels be present with high arterial tension in association with it, iodide of potassium acts as a valuable remedy in gradually reducing the vascular tension. Whether it acts directly upon the process in the vessels or by affecting metabolism prevents the production of toxic agents is not determined. Iodine after its absorption is found in greater amounts in the blood than in the tissues in health, but in disease the quantity in the tissues may be greatly increased. Thus it is found in increased amount in syphilitic masses of abnormal cells, as in gumma, and in the lesions of tuberculosis. This holds true also in carcinoma and to less extent in sarcoma, and in all such cases it is found combined with the lipoid rather than the proteins of the tissues.

ABSORPTION AND ELIMINATION.—Iodide of potassium is very rapidly absorbed and eliminated, appearing in the urine, according to Doux, in thirteen minutes after it is ingested, the daily amount excreted equalling about 80 per cent of the dose taken. Some of the drug tends to accumulate in the body. It is evident, therefore, that in the use of iodide of potassium we should give it freely and frequently until the residual amount has reached its limit, when smaller doses may be given, and given less frequently, for the purpose of maintaining the iodine influence. That is to say, the drug should be given up to the point of tolerance, whatever that may be, and then a smaller dose will be sufficient to maintain its influence by replacing the albuminoid compounds of iodine as they are slowly eliminated. On the other hand, if the iodide is being given for the purpose of eliminating some poison, as lead, for example, the dose cannot be greatly decreased, because in addition to the quantity ordinarily eliminated a portion is passed out as a double soluble iodide of lead. This theoretical deduction seems to find support in the fact that after the syphilologist reaches the full effect of the drug he often cuts the dose down to what he calls the "tonic dose," and so maintains the constant alterative effect without disordering the functions of the body. If he does not do this, the drug accumulates and causes chronic iodine cachexia, a state which it is important to avoid in grave diseases like syphilis, which depend for their relief so largely on the maintenance of vitality in the patient.

All traces of the iodine in the urine disappear four or five days after the last dose is administered (Elhers).

Therapeutics.—The medicinal uses of iodide of potassium may be divided into three great divisions, each of which is important. It is also employed for many conditions not included in these classes:

1. SYPHILIS.—The use of iodide of potassium in syphilis is recognized as a part of treatment for its relief. but it has no specific influence upon the parasite causing this disease. Neither does it, as does mercury, stimulate cellular resistance to the infection. Furthermore it does not materially influence the Wassermann reaction in the sense of cure, but it possesses the important power of causing resolution or absorption of pathological tissue induced by the infection. The article on Syphilis, Part IV, treats of this question, and it is only necessary to call attention to the fact that the drug is generally well borne in large amounts by advanced syphilitics, although this is not always the case. The term "therapeutic test" was applied by one eminent teacher to signify a state of the system produced by syphilis in which a diagnosis may be made by the fact that large doses of the iodide are borne without inconvenience. This resistance does not always prove the presence of syphilis, nor does the absence of this resistance prove the absence of this disease. Persons having hereditary asthma, gout, rheumatism, or some similar diathetic malady often resist the iodide, and, on the other hand, some syphilitics exhibit "iodism" after very small doses. In treating late syphilis the drug should be used in the dose of 10 grains (0.60) three times a day, and this amount gradually increased a grain or more a day until symptoms of "iodism" occur.

It is well to bear in mind that non-syphilitic persons who are taking, or have recently taken, iodides often give a positive reaction to the luetin test.

The quantity borne often amounts to from 100 to 200 grains (6.6–13.2) a day, and as much as 400 grains may be taken by some persons. The best way to use the iodide of potassium is to order for the patient a saturated solution of the drug, which contains in each drop about 1 grain, and at the same time a bottle of the compound syrup of sarsaparilla. To a tablespoonful of the latter the patient is to add the iodide solution, beginning with 10 minims (0.6) three times a day, and increasing a minim every dose each twenty-four hours.

In *tertiary syphilis* the iodide is often valuable rather to hold the pathological process in check than to affect the specific cause.

In *nervous syphilis*, be its manifestations what they may, iodide of potassium is a standard remedy, but mercury and arsphenamine are more active and useful in the early stages. It is not curative in sclerotic postsyphilitic changes nor in locomotor ataxia due to syphilis, except in the earliest stages, because destroyed cells cannot be restored, but it can be used to arrest further advance of the results of the disease. It may greatly improve the patient's condition by preserving cells not as yet entirely destroyed.

The therapeutic effect of this drug is much increased if hot vapor baths are used simultaneously with its internal administration.

2. METALLIC POISONING.—Owing to the fact that iodide of potassium forms soluble double salts with all the metals in the tissues in chronic poisoning, thereby aiding in their elimination, it should always be employed in chronic lead, zinc, arsenic, or mercurial poisoning.

3. ANTIRHEUMATIC.—Iodide of potassium is best suited, not to *acute articular rheumatism*, when the joints are very hot and painful, but to the secondary or subacute types, when the joints are enlarged and the case "hangs on"—now better, now worse. It acts well, under these circumstances, if combined with wine of colchicum seed. (See Rheumatism.) It is also to be tried in *sciatica*, *lumbago*, and *rheumatic neuralgia*, and it may be employed in *chronic pleurisy*, *pericarditis*, and *hydrocephalus* to cause absorption of the fluids. In these conditions, however, it often fails and cannot be relied upon.

In *aneurism*, particularly that of the aorta, the drug often does good, but its value rests largely upon the cause of the disease. If it is due to syphilis, the aneurism may cease to grow under its influence, and the pain, swelling, and pulsation gradually decrease.

In *asthma* iodide of potassium is valuable if the disease is of the pure bronchial type, but it should not to be employed if the cause is associated with gastric irritation or indigestion, as it makes the condition of the stomach worse. In *bronchitis* and *intestinal catarrh* where the condition of the mucous membranes is semi-chronic, and not relieved by chloride of ammonium, iodide of potassium should be used. If the bronchitis is chronic and the secretion profuse (bronchorrhea), iodide of potassium will make it worse. The dose for an adult in all these instances should be about 3 to 5 grains (0.2–0.3) three times a day, for small doses tend to increase secretion far more than large ones, which often seem to decrease it. In *pulmonary emphysema* iodide of potassium is often of great value chiefly because it benefits the associated chronic bronchitis.

In *chronic interstitial nephritis* small doses (5 grains [0.3] t. i. d.) are thought by some to check the disease, but it is to be remembered that the drug may produce untoward symptoms if the kidneys do not eliminate it, so that, if used at all, it must be given with great care. If the drug is well borne in *chronic parenchymatous nephritis*, it will cause an extraordinary increase in the urinary flow, and will often relieve very rapidly any dropsy which may be present.

The iodides or iodine are of the greatest possible value in preventing simple goiter which is endemic in certain areas. Its use may arrest the further growth of a simple goiter. In *exophthalmic goiter* iodides greatly improve the condition of the patient for a time and should be used to relieve severe symptoms or prepare a patient for operation. Their continued use, as a rule, makes the patient worse. They must be given with caution or not at all in adenomatous goiter except when it is found by the aid of the metabolimeter that its use decreases metabolism. Indeed, all cases of hyperthyroidism when treated with iodine should be so controlled. (See Iodine, Part II, important and Exophthalmic Goiter, Part IV.)

In *hepatic cirrhosis,* in its early stages, the iodide often does good in arresting the overgrowth of connective tissue, and in *arteriosclerosis* or atheroma of the bloodvessels it is of great service. A combination of iodide of sodium or potassium with a little digitalis will relieve vascular spasm and support a feeble heart.

A very important use of iodide of potassium is for the removal of *enlargements of the cervical glands* and those occurring in other parts of the body, but it should never be given if the glands are acutely inflamed or suppurating. (See Adenitis, Part IV.) Full doses are useful in *actinomycosis.* In the later stages of *pneumonia* the iodides are sometimes useful to aid in the absorption of the exudate, but they are contraindicated in pulmonary tuberculosis, except in the fibroid form and except in those cases which are dependent upon syphilis as an underlying dyscrasia, as they aid in the breaking-down of the lung.

Untoward Effects.—In some persons, after the use of the iodide, coryza comes on, so that the edges of the eyelids become reddened and the nose runs constantly; and it is a curious fact that small doses are more apt to produce such a result than large ones. This is followed, if the drug is freely given, by the more positive signs of "iodism" spoken of under Iodine.

In other cases acne breaks out on the face and disorders of digestion and gastric irritability come on. The acne can nearly always be prevented by giving arsenic at the same time with the iodide. In some cases petechial rashes break out on the legs, while in others great mental and physical depression appears, so that listlessness or melancholia may develop. Sometimes iodide of potassium causes diarrhea.

In persons susceptible to iodide of potassium care should be exercised when it is first administered lest sudden and dangerous edema of the glottis occur. Elsner has reported a case in which death due to this cause followed the administration of 30 grains of the iodide of potassium. Multiple hemorrhages from the skin and mucous membrane occurred.

If bullæ or blebs follow the use of the iodides or other rashes appear, it is said that atropine will afford relief.

Sometimes the iodide of ammonium or iodide of sodium or iodide of strontium will be borne when the iodide of potassium will not.

The hydrochloric acid and chloroform test for indoxyl sulphate of potassium in the urine is useless if the patient is taking iodides.

Administration.—The iodide of potassium, owing to its exceedingly disagreeable taste, should be given with the compound syrup of sarsaparilla, as already described, with fluidextract of liquorice, or in milk. Large amounts of these vehicles are to be used. A good way to give it is to add the drug to one of the liquid pepsins, and then to add this to warm milk, as in the directions for the preparations of junket given in Part III. The curd largely disguises the taste of the drug. The dose usually varies from 5 to 60 grains (0.3–4.0) three times a day, according to the condition of the patient. It is best given an hour after meals, so that it will not disorder digestion by irritating the stomach or interfere with the action of the gastric juice.

One of the best ways to take the drug is in capsule, but if this is done a drink of milk or water or other fluid should precede or follow it, in order to prevent the drug from coming in contact with the stomach in concentrated form.

IODIDE OF SODIUM.

Sodii Iodidum, U. S. and B. P., is used in the same doses and for the same purposes as the iodide of potassium, and is less irritant than the latter salt, as well as less depressant to the general system.

In obstinate *chronic joint disease* other than the tuberculous type it is useful, given intravenously in doses of 10 to 15 grains (0.65-1.0) once a day.

IODIDE OF STRONTIUM.

Iodide of strontium (*Strontii Iodidum,* U. S.) is used as a substitute for iodide of potassium, as it is less irritating to the stomach and less depressing to the general system. (See Strontium.)

IODINE.

Iodum, U. S. and B. P., is a non-metallic element found largely in seaweed and in mineral iodates and iodides. It should contain not less than 99 per cent of pure iodine, and be kept cool in glass-stoppered bottles.

It volatilizes slowly at ordinary temperatures.

Physiological Action.—The physiological action of iodine, so far as its alterative powers are concerned, is absolutely unknown. Applied to the skin, it stains it yellow, brown, or black according to the freedom of its application, and it acts without pain if the skin is intact. If very large amounts are used, it produces vesication. Upon mucous membranes iodine acts as a powerful irritant. Germain-Sée believed it to be a stimulant to the nutritive processes of the body and to the circulatory system, and he was certainly correct in regard to the influence it exercises over nutrition.

Absorption and Elimination.—The drug is rapidly absorbed, escapes from the body chiefly through the kidneys, the skin, the salivary glands, and it even appears in the milk of nursing women to such an extent that the nursing infant may be affected by iodism and suffer from gastro-intestinal disturbance in consequence of ingesting it.

Poisoning.—The symptoms of acute poisoning by iodine are those of acute gastro-enteritis, such as severe pain in the esophagus, stomach and abdomen, accompanied by violent vomiting and purging. An early symptom is the persistent strong metallic taste in the mouth, with markedly increased salivation. The pulse becomes rapid, running, and feeble, the face deathly pale, total arrest of urinary secretion takes place through renal irritation, and death occurs by failure of respiration, which is accompanied by loss of all vital power.

If the poisoning is not severe enough to cause death at once, a fatal result is, nevertheless reached after a few days by reason of the severe gastro-enteritis and the widespread fatty degeneration of the tissues which iodine produces.

The *treatment* of the poisoning consists in the use of a teaspoonful of sodium thiosulphate in a glass of water or large amounts of starch in any of its forms as the antidote, the employment of emetics and the stomach-pump, the application of heat to the body and extremities, and, finally, the employment of hypodermic injections of digitalis, and atropine or strychnine for the purpose of maintaining the strength of the circulatory and respiratory systems.

Untoward Effects.—Under the name of "iodism" the profession recognizes a state of the body brought on by the prolonged and excessive use of iodine in any of its forms. The earliest notable signs of this state are a peculiar metallic taste in the mouth, particularly in the morning, slight tenderness of the teeth and gums, increase of salivary secretion, a little morning nausea, a lack of appetite for breakfast, and perhaps some coryza or evidence of gastric irritation. Acne rosacea often comes on very early during the use of full doses of iodine. If the drug is continued, all these symptoms become more marked and the coryza becomes intense. Frontal headache and sore-throat often appear, and the pustular and bleb-like changes in the skin go on to active suppuration. Sometimes large boils appear or purpura hemorrhagica (iodic purpura) comes on. Slight catarrhal fever may develop.

In other cases the nervous system chiefly suffers. Twitchings of muscles, neuralgic pains in the trunk and extremities, and wasting of the testicles, mammæ, and all other tissues occur as the result of trophic disturbances. Anemia amounting to an actual cachexia is next produced. Loss of vision and paralysis may ensue in extreme cases. Soullier asserts that albuminuria may be developed in children after tincture of iodine has been freely applied to the skin, by reason of its absorption and irritation of the kidneys.

Therapeutics.—In all cases where the glandular system is in a state of chronic perverted functional activity, as in those diseases associated with disorder of the processes of nutrition, and often included under the single name of *scrofulosis*, iodine is of service unless there is active tissue break-down. In *enlargement* of *the lymph nodes* it is one of the best remedies we possess, but it ought not to be employed in those cases where rapid changes are going on in the gland, such as the formation of pus, since under these circumstances it will increase the size of the slough. Neither will it benefit the glandular enlargement of Hodgkin's disease or lymphatic leukemia. The drug ought never to be used in acute pulmonary tuberculosis, because it tends to disintegrate the tissues, and this is precisely what the disease is doing. In the exceedingly chronic form of pulmonary disease known as *fibroid tuberculosis* iodine may often be used with advantage. When inhaled as vapor it may be of service as a stimulant to the mucous membranes, but is never of value in tuberculosis so far as combating the true pathological change is concerned.

In regions where *goiter* is very prevalent iodine ranks as a most efficient preventive of the development of the disease and should be taken by all young persons in minute doses over long intervals of time. One per cent of sodium iodide added to the sodium chloride used with food is sufficient. When simple goiter has already developed these small doses of iodine should not be used constantly over long periods of time as if this is done the gland may enlarge instead of shrink. It is best to use it for thirty days and then repeat it occasionally at intervals of two weeks. It may take many months of treatment to produce any notable beneficial effect. Its value after the gland is greatly enlarged is comparatively slight. So too in true *exophthalmic goiter,* it has been shown, contrary to earlier belief, that fairly large doses of iodine, say 10 minims (0.65) or more of Lugol's solution three times a day is temporarily advantageous. This is particularly true when preparing a patient for operation who is a sufferer from this disease. A metabolic rate of +85 or more may be brought to nearly normal by this means and the danger of operation greatly reduced. When used over a long period of time iodine loses its value and when discontinued or persisted in the patient may become worse. Iodine is not a cure; it is a temporary modifying agent. Plummer has shown that in doses of as much as 60 minims a day it is specific for the gastro-intestinal crisis of this disease. Until recently it has been taught all iodides are contraindicated in adenomatous goiter. (See Iodide of Potassium and Exophthalmic Goiter, Part IV.) In cases of this type, with a very high metabolic rate, iodine may be used for a few days to render the patient fit for operation. This is important to bear in mind. (See Iodide of Potassium and Exophthalmic Goiter, Part IV.)

In *chronic bone disease* iodine applied about the affected joint in the form of the ointment diluted one-half with lard, or in the pure tincture will be found of service, and if *anemia* exists the syrup of the iodide of iron should be given internally.

The other external uses of iodine are many and important. As a slow counterirritant, which does not produce pain if properly employed, it is particularly useful in children, and may be employed in one to three coats, and no more, applied by means of a camel's-hair brush.

The proper way to use the tincture of iodine as a local counterirritant for adults is to give one good black coat at one sitting and not to repeat it until the skin has desquamated and become well renewed. If iodine is applied after desquamation of the skin has begun, it will cause agonizing burning pain, which nothing will relieve except the removal of the iodine by the use of a solution of iodide of potassium, which should be followed by a starch poultice. A good rule to follow is never to cause pain by the use of iodine, as the drug acts equally well if applied in such a way as to avoid suffering. In other words it is a low grade, continuous counterirritant and alterative for some of the drug is absorbed from the skin.

In *harassing, irritative cough* tincture of iodine may be painted over the supraclavicular spaces, and it will sometimes lessen the secretion in *chronic bronchitis* if used in this way. In *chronic rheumatism* affecting the joints and muscles it does good when locally applied. Often in *synovitis* the local application of iodine, provided the skin is not inflamed, causes increased swelling for some days. This should not cause alarm, for ultimately the swelling decreases greatly, and the cases in which this occurs are generally the best from a prognostic point of view.

In the course of *pulmonary tuberculosis* every now and then a "spot" in the chest will become "sore," probably due to a limited area of pleurisy, and under these circumstances tincture of iodine locally applied will give relief. In *lupus* the tincture may be painted around the edges of the growth, and even over its surface, with the object of retarding its spread. In *chilblains* an application of iodine ointment gives the greatest relief if diluted one-half with lard, and its use is probably the most efficacious measure at our disposal. In certain individuals who have "pains in the chest" iodine ointment may do good if rubbed in over the affected spot. As has been pointed out by others, iodine does good if muscular tenderness is present, while it fails if *pleurodynia* or *intercostal neuralgia* is the cause of the suffering. The latter troubles should be removed by the use of belladonna. In certain forms of skin diseases, such as *tinea tonsurans* and *circinata*, tincture of iodine may be applied with a camel's-hair brush, and even the entire scalp may be painted. A better way is to apply it to different spots each day. When *erysipelas* is present, the tincture may be painted around the edges of the inflamed area in order to prevent its spread.

Tincture of iodine is a useful application to heal *leg ulcers*, painting it over and around the lesion.

Within recent years tincture of iodine, in the form of the official tincture, or, more commonly, in 2 per cent solution in ethyl alcohol, has been largely and successfully employed to sterilize the skin at the site of operative procedures. In scalp *wounds*, or wounds of other hairy parts, and in wounds filled with dirt, as in the case of crushed fingers or toes, the parts should be thoroughly painted and swabbed with tincture of iodine, and no other antisepsis is required. Washing the parts with water before using the iodine is unwise, as the water swells the cells and prevents the iodine from acting as a penetrating antiseptic. (See Picric Acid.) The surgeon can also sterilize his hands by dipping them in 2 per cent iodine, and they may be largely decolorized afterward by washing them in a solution of boiled starch, hydrogen peroxide or ammonia water, or a 3 per cent carbolic acid solution.

In old persons or those in middle life *retraction of the gums* from the teeth sometimes comes on with fetid breath. This can be greatly relieved or cured by rinsing the mouth twice daily with 5 drops (0.3) of tincture of iodine in 2 ounces (60.0) of water.

Injections of iodine have been made into various serous cavities for the relief of chronic inflammatory processes. This is sometimes followed by unfavorable symptoms, and after the injection of tincture of iodine into the pleural cavity in pyothorax symptoms of poisoning have come on in some cases, the most common complication being convulsions. These are epileptiform in character and are followed by coma or collapse.

In *empyema* a solution of iodine 6 grains (0.4), iodide of potassium 6 grains (0.4), and water 1 pint (480 cc.) may be used daily as an irrigating fluid with good results; but this practice is not entirely devoid of danger, as too much of the iodine may be absorbed or the irritation produced in the chest by its injection may cause reflex and severe nervous symptoms. (For a better method see article on Empyema.)

The tincture of iodine may be used, according to Ringer, as an inhalation with signal benefit in the following three instances:

1. In the chronic forms of phthisis (*fibroid lung*). When the expectoration is abundant and when the cough in troublesome, its inhalation, used both night and morning, will generally lessen expectoration and allay the cough.

2. In children six to ten years of age, who after meals, or, independently of them, on exposure to cold, are seized with hoarseness, a hoarse, hollow cough and some wheezing in the chest. This affection, involving the larynx, trachea, and larger bronchial tubes, and often proving very obstinate, is apt to return and to persist for some time.

3. Some persons suffer with *itching of the nose*, of the inner canthus of one or both eyes, *sneezing, running at the nose*, of a watery fluid, weeping of the eyes, and *severe frontal headaches;* and these patients of various ages are greatly troubled, often for many years, with daily attacks of this character, lasting, it may be, several hours. Iodine inhaled often relieves this affection at once, lessening the headache and discharge from the nostrils. Its effect is most marked in respect to the itching.

Sydney Ringer generally used the following simple, handy, cleanly and effectual plan of inhalation: Heat well a jug capable of holding about 2 pints by rinsing with boiling water; then partly fill with boiling water, into which pour 20 to 30 minims (1.3-2.0) of the tincture of iodine; then direct the patient to put his face over the mouth of the jug and breathe the iodized steam, covering the head to prevent escape of the vapor. This inhalation should be used night and morning for five minutes or a little longer. Occasionally an excess of iodine will temporarily produce a sensation of soreness in the chest and throat, accompanied with redness of the conjunctiva, running from the nose, and pain in the head.

In some cases of *acute coryza* much relief may be obtained by sniffing the fumes of tincture of iodine from a bottle, as in the use of "smelling salts." The heat of the hand is sufficient to disengage the vapor in proper quantity.

A useful gargle in cases of *relaxed sore-throat* is a follows:

℞—Tincturæ iodi		f ʒj (4.0)
Potassii iodidi		ʒj (4.0)
Spiritus vini gallici		f℥j (30.0)
Aquæ destillatæ	q. s. ad	f℥iv (120.0).—M.

S.—Use 2 teaspoonfuls (8.0) in half a glass of water as a gargle three times a day.

It has been proved that in the proportion of 1 drop to the quart, tincture of iodine is capable of rendering polluted water fit to drink after the lapse of thirty minutes. After this time the iodine may be removed, so far as taste is concerned, by the addition of a pinch of sodium thiosulphate.

Administration.—Iodine is never used in solid form, and it has been taught that the tincture (*Tinctura Iodi*, U. S., and *Tinctura Iodi Mitis*, B. P.) should not be given internally, on the ground that it is precipitated in the stomach. Whether this be true or false, it is a fact that the tincture has been largely used in the *vomiting of pregnancy* and that occurring after the use of anesthetics with very good results. The dose is 5 to 10 minims (0.3-0.6), 2 to 5 minims (0.12–0.3), B. P., well diluted. Under the name of Lugol's solution (*Liquor Iodi Compositus*, U. S.) iodine is frequently used internally as an alternative and substitute for iodide of potassium; the dose is 5 to 10 minims (0.3–0.6), in water. *Tinctura Iodi Fortis*, B. P., is used as a local application.

Unguentum Iodi, U. S., and B. P., is used locally over enlarged glands. In the case of children or adults who have delicate skins the ointment should be diluted one-half with lard. This ointment should always be freshly made.

Contraindications.—Iodine when given internally is contraindicated in renal diseases, except in small doses, during the progress of acute inflammation, and whenever tissues are rapidly undergoing a breaking-down process.

IODOFORM.

Iodoform (*Iodoformum*, U. S. and B. P.) occurs in yellow powder or characteristic crystals, having a persistent odor.

Physiological Action.—The effects of iodoform upon the circulation, respiration, and other vital functions are very slight when the drug is used as a surgical dressing in ordinary amounts or when it is given by the mouth in average doses. It acts as an anesthetic upon mucous membranes, and produces those changes which we are wont, for want of a better term, to call "alterative," in the tissues with which it comes in contact. Iodoform is eliminated in the urine as iodine or as alkaline iodides, chiefly as iodide of sodium. The drug also escapes by the saliva as an alkaline iodide.

Poisoning.—If applied to an absorbing surface in susceptible individuals, iodoform may cause general systemic poisoning. This poisoning may be mild, in which case there is a general feeling of malaise, with nausea and the perception of various odors which are in reality not present. There may be headache and vomiting. If the system is still more impressed by the drug, these symptoms are followed by cerebral excitement, insomnia, loss of memory, loss of appetite, and a rapid pulse. In grave cases convulsive movements and maniacal delirium, alternating with coma, may be the dominant symptoms. The pulse is small and rapid, and there is often retention of urine or hematuria. Loebisch asserts that the mental excitement cannot be quieted by narcotics. If death occurs, the heart and respiration fail simultaneously. In addition to the fatty degeneration which such poisoning produces in all the vital organs, there is sometimes found an edematous condition of the pia mater or a low-grade leptomeningitis. These symptoms seem to occur more commonly in the aged. In the graver cases the onset of the poisoning is apt to be sudden, though from twenty-four hours to several days usually elapse between the application of the drug and the onset of the symptoms of poisoning.

TREATMENT of the poisoning by iodoform consists, according to Soullier, in the administration of bicarbonate of sodium to unite with the iodine and so aid in its elimination; the use of alcoholic stimulants to support the system; the employment of diuretics, and wrapping the patient in hot blankets to encourage free sweating, so relieving the kidneys. Kocher advised saline transfusion in such cases.

Untoward Effects.—It is not to be forgotten that iodoform when applied as a dressing may produce less violent symptoms than those just described. Sometimes a scarlatinal rash may develop with fever, malaise, and nervous disturbances.

Therapeutics.—Iodoform is used chiefly as a surgical dressing, but is by no means so popular for this purpose as it was at one time. It is antiseptic, but not germicidal. Germs may be found in powdered iodoform, and will even grown in it. When used locally, the drug does good by absorbing the liquids of the wound, and thereby removing the nidus for germ-growth, and when applied to large moist surfaces gives off free iodine and acts as well as a protective. There can be no doubt that iodoform when applied to a wound does good, not by destroying the bacteria directly or indirectly, but by inducing chemical changes in their toxins.

In *syphilitic sores* the following dressing will be found of great service: Iodoform, 20 grains (1.3); oil of eucalyptus, ½ fluidounce (16.0); or a powder of iodoform ½ ounce (16.0), camphor 75 grains (5.0), and essence of rose 2 drops (0.1), may be employed. In *eczema*, with tingling and itching, the following application will give relief (Ringer):

℞—Iodoformi	gr. iv (0.25)
Olei eucalypti	f℥j (4.0)
Petrolati	℥j (30.0).—M.

S.—Apply locally.

Internally, iodoform is used in *tertiary syphilis* in all its forms in the dose of from 1 to 5 grains (0.6–0.3). Bartholow recommended it most highly in *catarrhal jaundice* and in the early stages of *hepatic cirrhosis*.

The influence of iodoform upon the tubercle bacillus is very great, and it is largely used in the treatment of *tuberculous disease of the joints and pleuræ*. The pus is allowed to escape under antiseptic precautions; the cavity is washed out with warm boric acid or phenol solutions of low strength, and from 1 to 6 drams (4.0–24.0) of an emulsion of iodoform and sterilized sweet oil are injected and allowed to remain. The strength of the iodoform-and-oil emulsion should usually be 10 per cent. Should the abscess cavity fail to heal after these injections have been repeated every few days for some time, it must be reopened, scraped, and injected again or packed with iodoform gauze. The iodoform also promotes healing through its alterative influence, which aids in the absorption of the inflammatory exudate. Should tubercular glands be present, injections may be made into them even if pus has not formed.

Used by means of a powder-blower, iodoform will often relieve the hoarseness and discomfort of *laryngeal phthisis*, but it must be pulverized most minutely. Sometimes a spray may be used, which should consist of spirit of turpentine and sweet oil, half-and-half, and contain 2 grains (0.12) of iodoform to each ounce (30.0). This mixture may also be used in chronic *bronchial catarrh* to lessen the cough and fetid discharge. In the early stages of phthisis several clinicians claim to have obtained good results by the daily hypodermic injection into the back of 30 minims (2.0) of a 1 to 100 solution of iodoform in oil of sweet almonds, but this treatment has not found favor, in the United States at least.

For *fissure of the anus* and *irritated hemorrhoids* 5 grains (0.3) of iodoform in a suppository may be placed in the rectum, and after it has remained there a few minutes defecation may take place with little or no pain. The pain following operations on the female perineum may also be much relieved in this manner. In the *rectal tenesmus* of *cholera infantum* an injection of 1 ounce (30.0) of sweet oil with 5 grains (0.3) of iodoform will give great relief if used after or before enteroclysis.

Administration.—The ointment of iodoform (*Unguentum Iodoformi*, U. S. and B. P.) is useful when applied over fetid sores. It should always be freshly made. The drug itself may be given in 1- to 5-grain (0.06–0.3) doses three times a day. The suppositories (*Suppositoria Iodoformi*) are official in the B. P.; each one contains 3 grains (0.2) of iodoform. (See also Europhen and Thymol Iodide.)

IPECACUANHA.

Ipecacuanha, U. S., or *Ipecacuanhæ Radix*, B. P., or ipecac, is the root of *Cephælis Ipecacuanha* (*Psychotria Ipecacuanha*, B. P.). It contains the alkaloids, emetine (*Emetinæ Hydrochloridum*, U. S.), cephæline and psychotrine. Of these only emetine is used in medicine.

Physiological Action.—Locally applied to mucous membranes, ipecac acts as an irritant, and if applied for a long period to the skin produces vesicles and irritation. Very minute doses have little noticeable effect, but large ones produce nausea, relaxation, vomiting, free secretion into the bronchial tubes, and a profuse flow of saliva. The emesis has been thought to be due both to the irritation of the stomach and to an effect upon the vomiting center in the medulla (Fig. 53), but the large doses of emetine now used by the hypodermic needle in the treatment of amœbic dysentery without producing vomiting would seem to prove that ipecac given by the stomach acts on that organ directly. Ipecac is eliminated by the kidneys, the gastro-intestinal mucous membrane, and the skin (Binz).

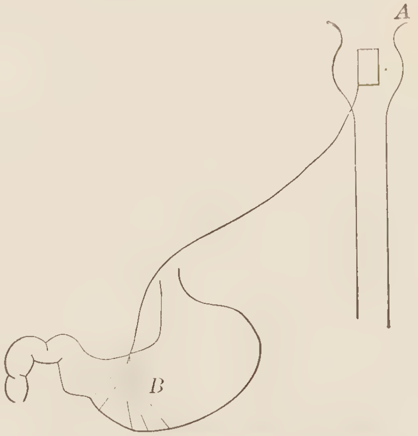

FIG. 53.—*A*, vomiting center in the medulla said to be stimulated by ipecac; *B*, nerves in mucous membrane of stomach irritated by ipecac.

If emetine is given in lethal dose to one of the lower animals, death is due to failure of respiration, but when it is given by a vein it acts as a powerful cardiac depressant as well. For this reason, if emetine is given intravenously, it should be put in 100 cc. of normal salt solution and injected slowly.

Therapeutics.—Ipecac is used as an emetic where a fairly rapid action is required. It is particularly useful where the stomach of a child is overloaded with food. In cases of poisoning it is hardly active or rapid enough as an emetic, and is not so good as mustard or sulphate of zinc. In babies and young children an attack of *bronchitis* often causes digestive disorders by reason of the mucus coughed up from the lungs being at once swallowed instead of spat out of the mouth. In these cases the stomach may be relieved and the state of the lungs improved by the use of an emetic dose of syrup of ipecac, 2 to 3 drams (8.0–12.0). Often if this dose be not large enough to produce emesis it will purge the child and remove the mucus by the bowel.

In some cases of obstinate *vomiting* small doses of ipecac will act as a most successful cure, provided that the vomiting is due not to inflammation and excitement, but to depression. The proper dose of ipecac for this purpose is $\frac{1}{8}$ to $\frac{1}{4}$ grain (0.008–0.015) or less every half-hour until five or six doses are taken.

In some cases of the *vomiting of pregnancy* it is useful, in toxic cases it utterly fails; 1 minim (0.06) of the wine or $\frac{1}{8}$ to $\frac{1}{4}$ grains (0.008–0.015) of the powdered ipecac, repeated every half-hour for six or seven doses, is all that should be used. In the *morning vomiting of drunkards* ipecac is of service, but it is not as good a remedy as are small amounts of arsenic or hydrochloric acid.

In true *amœbic dysentery* ipecac, or its alkaloid emetine, is one of the best remedies we possess for the relief of acute manifestations. When the disease is malignant, as it occurs in the tropics, ipecac, or emetine, should be given. The ipecac is to be given on an empty stomach in the dose of 30 grains (2.0) in freshly made pills of 5 grains (0.35), coated with salol or keratin, so that the ipecac will not irritate the stomach, but be dissolved in the bowel. When this causes vomiting it may be preceded one hour by 30 minims (2.0) of tincture of opium, or 20 grains of chloral, which is used to decrease the tendency to vomit. This dose should be repeated every night for three or four nights, and, in severe cases, for a week or more. *Absolute rest in bed for two weeks is essential for success.* Finally, a profuse gray, mushy stool is passed. The passage of this stool is a most favorable prognostic sign, and its non-appearance is equally significant of failure. There now occurs a decrease in pain and a lessening of the fever and of bloody discharges. Retching, vomiting, delirium, and exhaustion do not contraindicate this plan of treatment. If the first dose is rejected, it may be repeated in a few hours, preceding it by the laudanum. Counterirritation is to be applied to the belly, and stimulants freely used to combat great depression. It is asserted by Rogers and many others that, if this plan of treatment is used in the early stages of *amœbic dysentery* and *hepatitis, hepatic abscess* can be prevented in 90 per cent of the cases. Rogers gives 30 grains (2.0) daily for a period of two or three weeks in such cases. If an abscess has formed, it must be evacuated by *puncture*, injected with quinine solution, and the ipecac continued.

Vedder, of the U. S. Army, has proved that the emetine in ipecac is destructive to the *amœba hislolytica* and more recently Rogers has shown that the dose of ipecacuanha named above can be efficiently substituted by the intramuscular injection once or twice a day of ½ to ⅔ grain (0.03–0.04) of emetine hydrochloride dissolved in 30 minims (2.0) of normal salt solution. By this means nausea and vomiting are avoided and a cure is effected in about one-half the time. Such doses can now be obtained already prepared in sterile ampoules, or if need be the solution can be boiled before it is used. In obstinate cases both emetine intramuscularly and ipecac by the mouth are to be resorted to, cleansing the bowel first with a saline purge. Excessive diarrhea is to be controlled by paregoric. Usually a course of at least fifteen days is required, but after the first seven days, an interval of seven days' rest should be allowed because emetine is cumulative and capable, if given continuously, of acting as a cardiac depressant. In severe cases the emetine hydrochloride should be diluted with normal salt solution and given very slowly intravenously, particularly in the stage of onset. It is becoming increasingly evident, however, that although emetine given hypodermically destroys the active amœbæ, it does not affect the encysted forms and that the patient is not really cured but the active condition merely palliated, for relapses are common after some time and the patient endangers others by being a carrier. A cure is not produced even if the stools fail to show the *Entamœbœ histolytica.* When the patient is very ill the emetine may be used first and when improvement occurs the full effect of the crude powdered drug may be obtained by its use. (See Yatren and Stovarsol, Part II and Dysentery, Part IV.)

In *choleraic diarrheas* and *cholera morbus* ipecac is said to be of service in the dose of 3 grains (0.2) every two hours if opium is given to control nausea.

No less a person than Trousseau asserted that ipecac was a *hemostatic,* and it is said to be a most effective remedy in small doses in *hemoptysis,* and in all hemorrhages which are capillary in character, but the manner of its action is obscure.

Ipecac may be used in the early stages of *bronchitis,* to act as a sedative to the inflamed mucous membrane and to promote secretion. Under these circumstances it is best combined with citrate of potassium. (See Bronchitis.)

Ringer and Murrell have found that inhaling ipecac spray is very useful in *chronic winter cough* or *bronchitis,* particularly when there is present shortness of breath. The pure wine may be used in a spray apparatus or be diluted one-half with water. While the throat may seem temporarily worse, the shortness of breath rapidly decreases and marked improvement takes place in the cough. In order to prevent the wine which collects in the mouth from being swallowed, and nausea and vomiting thereby induced, the patient should be directed to rinse his mouth thoroughly every few minutes. The inhalation should not last at first over three or four minutes, and, until it is known how well the patient will bear the application, the wine should be diluted twice or thrice with water and alcohol, equal parts.

It is stated that powdered ipecac smeared on the skin will greatly relieve the pain and swelling produced by the *stings of bees.*

Untoward Effects.—The hypodermic use of emetine is prone to produce local inflammation and pain. The free use of emetine in pregnant or menstruating women is contraindicated owing to its stimulating effects on the uterus. In pregnancy not more than $\frac{1}{2}$ grain a day is to be given, as it may cause abortion in larger doses. When given in full repeated doses by the mouth, diarrhea and neuritis may develop. This is also true of too generous hypodermic or intramuscular medication, and death from general asthenia and cardiac failure may follow its too free use. It seems to have a cumulative effect in certain instances.

Administration.—The syrup (*Syrupus Ipecacuanhæ,* U. S.) is given in the dose of $\frac{1}{2}$ to 1 dram (2.0–4.0) as an expectorant, or in the same dose as an emetic to an infant. *Fluidextractum Ipecacuanhæ* (U. S.), *Extractum Ipecacuanhæ Liquidum* (B. P.) is given in the dose of 30 minims (2.0) as an emetic to an adult. The troches (*Trochisci Ipecacuanhæ,* B. P.) contain $\frac{1}{4}$ grain (0.015) each. *Trochisci Morphinæ et Ipecacuanhæ,* B. P., each of which contains $\frac{1}{36}$ grain (0.002) of morphine and $\frac{1}{12}$ grain (0.005) of ipecac, are used in *sore-throat,* dissolved in the mouth. Dover's powder (*Pulvis Ipecacuanhæ et Opii,* U. S.; *Pulvis Ipecacuanhæ Compositus,* B. P.) is given in the dose of 5 to 20 grains (0.3–1.3). It contains 1 part of opium, 1 part of ipecac and 8 parts of sugar of milk. (See Opium.) The dose of emetine (*Emetinæ Hydrochloridum,* U. S.), by the needle, is $\frac{1}{2}$ to $\frac{2}{3}$ grain (0.025–0.04). Powdered ipecac is given in the dose of $\frac{1}{10}$ to $\frac{1}{4}$ grain as a stimulant to duodenal secretion.

The additional British preparations are the pill of ipecac and squill (*Pilula Ipecacuanhæ cum Scilla,* B. P.), given in the dose of 5 to 10 grains (0.3–0.6), and the vinegar of ipecac (*Acetum Ipecacuanhæ,* B. P.), given in the dose of 5 to 30 minims (0.3–2.0), which are used as expectorants.

IRON.

Iron (*Ferrum,* U. S. and B. P.) is a metal which is used both as a medicine and a food—a food because it forms part of the body when taken into the organism and is used by the system in the making of blood. The number of its official salts and compounds is far in excess of the needs of practical physicians, and one-half the preparations are rarely, if ever, used.

Physiological Action.—Iron has little or no effect upon the system when given in a single dose, but repeated doses cause an increase in the number of red blood corpuscles, and plethora, or an increase in the quantity and quality of the blood. This statement which is in accord with clinical experience has recently been controverted by several experimenters who have claimed that if given to dogs made anemic by bleeding it causes no increase in hemoglobin or red cells. The condition of anemia so induced is not closely allied to the secondary anemias in human beings and the active clinician is still convinced that iron has the power above stated. Much discussion has arisen as to whether iron is absorbed when given as a drug in the form of one of the inorganic salts. One theory has been that only the organic iron of the food is absorbed, and that metallic iron when given freely allows this absorption to go on both by stimulating the bowel and by entering into combination with the sulphuretted hydrogen in the intestine, thus permitting the organic iron to escape into the system. That both forms of iron are absorbed and eliminated is now certain. (For a discussion of some of these views, see article on Anemia.) The absorption of iron takes place chiefly in the first 20 inches of the small bowel and takes place through the epithelial cells. The iron granules are then taken up by the leukocytes and carried to the liver, although some of them may be deposited in the mesenteric glands. Some of it also is deposited in the bone-marrow. Iron, when it enters the stomach, is probably changed into the chloride, and then, on entering the duodenum, is changed to the carbonate. If, however, iron is given in excessive doses, much of it remains unabsorbed; it is changed into the sulphide of iron in the bowels and escapes with the feces. Careful studies have shown that the iron, when once absorbed, escapes from the body very slowly, and that its pathway of escape is not by the bile or in the urine, but by the walls of the colon and rectum, which excrete it, so that it may be recovered from the feces. It has been asserted that it is never released from the body, but this is untrue. Whether it acts as a stimulant to blood manufacture or simply supplies the glands with blood-making material is not known, but the latter is probably the correct view. Iron, perhaps, causes oxidation to go on more rapidly by reason of its peculiar power of converting oxygen into ozone, and in this manner acts as a stimulant to nutrition and bodily activity.

The preparations of iron consist in the soluble and insoluble salts or forms. Of these the insoluble are better than the soluble, because nearly all the soluble salts of iron are precipitated by the gastric juice and have to be slowly redissolved. Nearly all iron preparations are capable of acting as more or less powerful astringents, and so are apt to cause constipation and to disorder digestion if given in large doses. The most astringent of all these preparations are Monsel's salt (the *Ferri Subsulphas,* U. S. and B. P.) and ferrous sulphate (*Ferri Sulphas,* U. S. and B. P.). Closely following these in astringency are the ammonio-ferric alum (*Ferri et Ammonii Sulphas*), and ferric chloride (*Ferri Chloridum,* U. S.). The least astringent preparations are

Quevenne's iron, or iron by hydrogen (*Ferrum Reductum*, U. S. and B. P.), saccharated ferrous carbonate (*Ferri Carbonas Saccharatus*, U. S. and B. P.), Basham's mixture (*Liquor Ferri et Ammonii Acetatis*, U. S.), the citrates, tartrates, and the lactate and phosphate of iron.

Therapeutics.—The chief indications for the administration of iron are those forms of *anemia* (see Anemia) characterized by a decrease in the normal quantity of hemoglobin in the blood as determined by the hemoglobinometer, as, for example, chlorosis. Its chief contra-indication is plethora. When used in small dose (¼ to ½ grain—0.015–0.3) it is quite as efficacious as in large amounts, and less apt to disorder the stomach, but the doses given in this article are the classical ones usually prescribed by physicians. In some cases of anemia of a semi-pernicious type large doses of iron are really needed, probably because the system is deranged in such a manner that an excessive loss or elimination of iron is constantly present. (See Liver Therapy under Anemia, Part IV.) Large doses compensate for this leakage and afford the quantity needed for physiological purposes. Iron should not be used as a tonic unless some direct indication for its employment is present, and no drug is more abused, in this respect than iron. As every preparation possesses some peculiarity, the use of each will be considered separately.

Basham's Mixture.

Under the name of Basham's Mixture (*Liquor Ferri et Ammonii Acetatis*, U. S.) a very useful and elegant preparation of iron is employed. It is chiefly employed in the *anemia of acute* and *chronic parenchymatous nephritis*, as it also acts as an efficient diuretic and mild diaphoretic. (See Nephritis.) It is made up as follows:

Tincture of chloride of iron	4	parts.
Dilute acetic acid	6	"
Solution of ammonium acetate	50	"
Aromatic elixir	12	"
Glycerin	12	"
Water	16	"

The dose is from 1 to 4 drams (4.0–16.0), well diluted.

Cacodylate of Iron.

Under the name of cacodylate of iron a compound has been introduced which is given in cases of *anemia*, in which the hemoglobin and the corpuscles are lacking, since by this means we obtain the effect of both iron and arsenic. The salt may be given by the mouth in the dose of ¼ to 1 grain (0.015–0.06) three times a day, in solution, or in urgent cases in the dose of ⅛ to ¼ grain (0.008–0.015) by the hypodermic needle three times a day. It is asserted by Gilbert and Tereboullet that this is not productive of local or renal irritation, and in the *albuminuria of tuberculosis* may even be beneficial.

Carbonate of Iron.

The saccharated ferrous carbonate (*Ferri Carbonas Saccharatus*, U. S. and B. P.) is very slightly astringent, and may be used in pill form under the name of *Pilulæ Ferri Carbonatis*, U. S. (*Pilula Ferri*, B. P.), sometimes called "Blaud's pill," or in Griffith's pill, which also contains myrrh. The dose is about 3 grains (0.2), 5 to 15 grains (0.3–1.0), B. P. This preparation of iron is largely used for the treatment of *amenorrhea* dependent upon anemia. Under the name of *Mistura Ferri Composita*, B. P., or Griffith's mixture, a liquid preparation is used for the same purposes as the pills just named, in the dose of 1 to 2 tablespoonfuls (15.0–30.0). *Massa Ferri Carbonatis*, U. S., sometimes called Vallet's mass, is given in pill in the dose of from 1 to 10 grains (0.06–0.6).

Chloride of Iron.

Tincture of ferric chloride (*Tinctura Ferri Chloridi*, U. S.; *Tinctura Ferri Perchloridi*, B. P.), often called tincture of the muriate of iron, is one of the best and most useful preparations of iron. It is a mild diuretic. This diuretic effect does not depend upon the presence of muriatic ether, as has been taught, since this is not present, and is difficult to prepare except there is an excess of chlorine. According to researches of Dr. S. Weir Mitchell, the only ether present is nitrous ether, and this is devoid of power used in small quantity. As chloride of iron itself is diuretic, it is probable upon this that the diuresis produced by it depends. The dose of the ferric chloride (*Ferri Chloridum*, U. S.) is 1 to 3 grains (0.06–0.2). Tincture of ferric chloride is considered a specific in *erysipelas*, and should be given in full dose and frequently repeated if it is to be of any service. (See Erysipelas.) Ten minims (0.6), well diluted, every hour are not too much if the stomach of the patient does not rebel. In *chronic Bright's disease* it is of value in that it sometimes decreases the albuminuria, but it possesses no curative power for obvious reasons. In *secondary anemia* it is useful, and owing to its acid content is a doubly effective tonic in cases in which not only iron but hydrochloric acid is needed. Persons who are susceptible to poison ivy may, if they fear exposure, apply a solution of ferric chloride in water (5 per cent) to the exposed parts of the skin and allow it to dry where applied. The dose of *Liquor Ferri Chloridi*, U. S., is 4 to 10 minims (0.25–0.6). It is rarely used internally, but chiefly as a powerful local astringent. *Liquor Ferri Chloridi*, is identical with *Liquor Ferri Perchloridi*, B. P. *Tinctura Ferri Perchloridi*, B. P., is used internally in the dose of 5 to 15 minims (0.3–1.0).

Given by the stomach, tincture of ferric chloride is useful in *acute tonsillitis*. It is best to give it in large doses, with an ice-bag placed on the anterior part of the neck. When used internally it should be well diluted with water and taken through a glass tube to protect the teeth. The strong solution of perchloride of iron (*Liquor Ferri Perchloridi Fortis,* B. P.) is a powerful styptic.

Citrates of Iron.

The four citrates of iron are soluble in water and so are readily added to liquid prescriptions, and they are also of value because they are but slightly irritant and astringent and do not disorder the alimentary canal. *Ferri Citras,* and *Ferri et Ammonii Citras,* U. S. and B. P., occur in garnet-red scales, and are given in the dose of 5 grains (0.3). The solution of the citrate of iron (*Liquor Ferri Citratis*) is given in the dose of 10 minims (0.6). Ammonio-citrate of iron in solution in sterile glass ampoules is now placed upon the market for intramuscular use, usually with a small amount of quinine and urea hydrochloride to prevent pain. (See Anemia.) The *Ferri et Quininæ Citras,* B. P., and the *Ferri et Strychninæ Citras* are given in the dose of 3 to 5 grains (0.15–0.3) and 1 to 3 grains (0.06–0.2), respectively. *Ferri et Quininæ Citras Solubilis,* U. S., is given in the dose of 3 to 5 grains (0.15–0.3).

Hydroxide of Iron.

Ferric hydroxide (*Ferri Hydroxidum*) is the *antidote* to *arsenic,* but to be efficacious it must be freshly prepared. It is to be made by precipitating any liquid preparation of iron by the addition of an alkali, such as ammonia, or by the addition of magnesium oxide. The resulting precipitate is the antidote, and the supernatant liquid is to be poured off. If ammonia is used, the precipitate must be washed with water several times to get rid of the alkali, which will render the antidote too irritant to be swallowed if it is allowed to remain with the precipitate. Magnesia is an antidote in itself, and should be preferred under all circumstances. The antidote should be given in excess, and as much as a pint of the iron solution should be precipitated. The magnesium oxide should be freely added, as too much of it cannot be given. The antidote to arsenic is official as *Ferri Hydroxidum cum Magnesii Oxido,* U. S. In the Prussian Pharmacopœia this is known as the *Antidotum Arsenici.* (See Arsenic, Poisoning by, for official method of preparing antidote.)

Iodide of Iron.

The syrup of ferrous iodide (*Syrupus Ferri Iodidi,* U. S. and B. P.) is a syrupy liquid of a sweet, iron-like taste, containing about 5 per cent by weight of ferrous iodide. It should contain no free iodine, and if a sample of it strikes a blue color with starch it should be discarded. It is largely used in *anemia* associated with catarrhal states, and is useful in the *eczema* of young children when this is dependent upon lack of vitality or anemia. The dose to a child of two years is 3 to 6 minims (0.2–0.4), well diluted, and to an adult 30 to 40 minims (2.0–2.6) in water, to be taken through a glass tube to protect the teeth.

The saccharated ferrous iodide (*Ferri Iodidum Saccharatum*) is used in place of the syrup in the dose of 2 to 5 grains (0.12–0.3). The pills of ferrous iodide (*Pilulæ Ferri Iodidi*, N. F.) each contain 1 grain (0.06) of ferrous iodide, and are given in the dose of one to three pills.

Phosphates of Iron.

There are two phosphates of iron—*Ferri Phosphas Solubilis*, U. S., or *Ferri Phosphas Saccharatus*, B. P., and *Ferri Pyrophosphas Solubilis*. Ferric phosphate itself is insoluble and is rarely used. The official forms are, however, quite soluble, and useful in the dose of 2 to 5 grains (0.12–0.3). *Syrupus Ferri Phosphatis*, B. P., is given in the dose of 1 fluidram (4.0). Phosphate of iron is one of the ingredients of *Syrupus Ferri Phosphatis cum Quinina et Strychnina*, B. P., which is given in the dose of 1 fluidram (4.0), and of the elixir of iron, quinine, and strychnine phosphates (*Elixir Ferri, Quininæ et Strychninæ Phosphatum*), given in the same dose as the syrup.

Reduced Iron.

Quevenne's iron (*Ferrum Reductum*, U. S., *Ferri Redactum*, B. P.) is an iron-gray or reddish powder which is frequently adulterated with lampblack. If it is pure, it should burn in sparks when dropped into a flame; but if lampblack is present this will not occur. It should also yield no sulphuretted hydrogen on adding sulphuric acid to it. It is tasteless, and may be given to children for this reason in pills or gum-drops, or placed inside of small chocolate creams, or in the form of troches (*Trochisci Ferri Redacti*, B. P.), each lozenge containing 1 grain (0.06) of the reduced iron. It is used solely in *anemia*, and is one of the least astringent of the iron preparations. Dose $\frac{1}{10}$ to 2 grains (0.006–0.12).

Subsulphate of Iron, or Monsel's Salt.

Monsel's solution (*Liquor Ferri Subsulphatis*, N. F.; *Liquor Ferri Persulphatis*, B. P.) is sometimes wrongly called the solution of the persulphate of iron, and is one of the most powerful styptics or hemostatics that we have. It is never to be employed where a hemorrhage is to be controlled through the circulation, but only when the solution can come in direct contact with the bleeding spot. The objection to its use is the hard, black, and dirty clot which it forms on coming in contact with blood. In *hemoptysis* Monsel's solution has been used in fine spray consisting of from 10 to 60 minims (0.6–4.0) to the ounce (30.0) of distilled water. It is useless because it does not reach the bleeding spot. In *uterine hemorrhage* from any cause the dilution may be half-and-half, or if the *hemorrhage be from a polypus* or the cervix uteri the pure solution should be used, locally applied. In *nose-bleed* Monsel's solution may be employed diluted one-half or pure; but its use is not to be commended, because of the hard, black clot which is formed and the uncomfortable sensations and pain produced in the nasal chambers. Plugging the nostrils, and if need be the posterior nares, with pledgets of cotton is generally sufficiently efficacious particularly if the cotton is wet with adrenalin solution. (See Epistaxis, Part IV.)

For the *intestinal hemorrhage* occurring during or after typhoid fever Monsel's solution has been given, but should not be so employed, as it is decomposed in the stomach before it reaches the intestine. In its stead Monsel's salt (*Ferri Subsulphas*) may be given in pills of 3 grains (0.2) each, the pills being made hard enough to escape into the intestine before the stomach dissolves them. One pill may be given every hour but it is an uncertain remedy. *Hematemesis* due to bleeding in the stomach may be treated by 3-minim (0.2) doses of the solution in a little water. It should be remembered, however, that the drug is irritating if frequently repeated.

In *tonsillitis* and *pharyngitis* a quite efficient application is pure Monsel's solution applied by means of pledget of cotton or camel's-hair brush, or equal parts of the solution and glycerin may be used. This application is often as painful as it is efficient, and care must be exercised that an excess of the fluid be not present, as it may drop into and irritate the larynx. In *diphtheria* this method of treatment may be used if peroxide of hydrogen cannot be obtained.

The antidote to Monsel's solution is common soap.

Sulphate of Iron.

Ferrous sulphate (*Ferri Sulphas*, U. S. and B. P.) is used internally in the dose of 5 grains (0.3) in pill form in *chronic diarrhea* with *anemia*. Externally, in a solution of the strength of 5 to 25 grains to the ounce (0.3–1.6 : 30.0), it is used as an astringent lotion. Two other forms of the sulphate are also employed—namely, the dried (*Ferri Sulphas Exsiccatus*, U. S. and B. P.) and the granulated (*Ferri Sulphas Granulatus*, U. S.), each of which is given in the dose of 3 grains (0.2).

Wines of Iron.

The bitter wine of iron, no longer official, is useful as a bitter tonic in *anemia* in both children and adults, and may be advantageously accompanied with cod-liver oil. It is given in the dose of 1 to 2 fluidrams (4.0–8.0) or more. This wine is composed of soluble citrate of iron and quinine, tincture of sweet orange peel, syrup, and stronger white wine.

Vinum Ferri Citratis, B. P., is composed of the citrate of iron and ammonium, tincture of sweet orange peel, syrup, and white wine. The dose is identical with that of the bitter wine, and it is used for the same purposes.

The plaster of iron (*Emplastrum Ferri*) is prepared from the hydrated oxide of iron.

The *Liquor Ferri Acetatis*, B. P., is given in the dose 5 to 15 minims (0.3–1.0).

Untoward Effects of Iron.—Iron is apt to cause gastric distress and frontal headache in persons who are susceptible to its use. Even one dose will cause this trouble in some patients. In many instances the frontal headache will be found to be due to the constipation which has been brought on by the iron, and will be relieved if mild laxatives or purges are used. The state of the bowels should always be inquired into when iron is being used, and laxatives given whenever constipation is present. In rheumatic and gouty persons frontal headaches are a common symptom when iron is given, and purgatives will not generally give relief. Garrod and Haig have shown that iron decreases the elimination of uric acid, and they think this may account for the production of headache in the case of rheumatic patients under its influence. Sometimes salts of iron produce vesical irritation and a constant desire to urinate, causing mucus to form in abnormal amount in the bladder. In children its use may result in nocturnal incontinence of urine.

ISACEN.

Isacen, or diacetyl-dioxyphenyl-isatin, has been introduced as a mild and gentle laxative to be used in cases of *subacute* and *chronic constipation*. It is claimed for it that it passes through the alimentary canal without being absorbed and without any irritant effect and by virtue of its non-absorption produces no systemic effects and no effect on the liver and kidneys. It is also said to pass through the stomach unchanged but by reason of the alkaline juices of the intestine to be changed, by the splitting off of the diacetyl groups, when the dioxyphenyl-isatin produces the laxative effect, the chief influence being, it is thought, on the colon. It moves the bowels in about eight hours. It appears on the market in tablet form each tablet containing $\frac{1}{13}$ grain. The dose is from 1 to 4 tablets.

JALAP.

Jalap (*Jalap*, U. S. and B. P.) contains two resins, jalapin and convolvulin, neither of which is used in medicine by itself, though both of them enter into the resin of jalap, *Resina jalapæ*, of the U. S. P. The term jalapin is sometimes employed to designate the pure resin.

In overdose, jalap or its resin causes vomiting and purging, with gastro-enteritis.

Therapeutics.—Jalap is used in medicine as a hydragogue purge to relieve *dropsy* of any origin. It may be used to deplete in cases of *general plethora* with *cerebral congestion*, and owing to its tastelessness is a useful active cathartic if given in the proper dose—namely, 1 to 2 grains (0.06–0.12) in ½ ounce (16.0) of syrup of rhubarb. Combined with calomel, it is preferred to all other purges by some practitioners, particularly if the liver is torpid. Jalap in large doses must be used with caution in persons who are feeble, and it is contraindicated in cases suffering from gastric or intestinal irritation.

Administration.—Jalap may be given in the form of the compound powder (*Pulvis Jalapæ Compositus*, U. S. and B. P.), dose 15 to 40 grains (1.0–2.6), which is composed of 35 parts of jalap and 65 parts of bitartrate of potassium; and the resin (*Resina Jalapæ*, U. S. and B. P.), dose for an adult 2 to 4 grains (0.12–0.25). The tincture (*Tinctura Jalapæ*, B. P.) is given in the dose of ½ to 1 fluidram (0.2–4.0); the extract (*Extractum Jalapæ*, B. P.) is used in the dose of 2 to 8 grains (0.12–0.48).

JEQUIRITY.

This is a plant known as *Abrus precatorius*, the seeds of which are poisonous when applied to a wound. An active principle, abrin, is composed of paraglobulin and α-phytalbumose, which closely resemble snake-venom in their action. Jequirity is never used internally in medicine in the United States. An infusion of the powdered seeds, made by adding ½ a dram to 1 ounce (2.0–32.0) of water at 104° F., may be painted with a brush on the inside of the eyelids in cases of *chronic granular conjunctivitis*, in order to produce an acute diphtheritic inflammation that will so change the chronic process present as to permit of cure. If an excessive action is developed, it may be controlled by hot compresses made of very dilute solutions of corrosive sublimate. The solution of the drug undergoes decomposition with great rapidity, and should be freshly prepared each time it is used, or 4 to 8 grains (0.25–0.5) of boric acid should be added to preserve it. The drug is a powerful cardiac depressant poison when injected into the circulation. Whether the seeds produce poisoning when swallowed is doubtful, some asserting that they cause gastro-enteritis, others that they are harmless. Probably much depends on the activity of digestion and absorption at the time of ingestion.

JUNIPER.

Juniperus is the fruit or berry of *Juniperus communis*, an evergreen of Northern Europe and America. It contains a volatile oil and an amorphous principle, juniperin.

Physiological Action.—Juniper acts as a gastric stimulant and tonic, as a mild diaphoretic if combined with alcohol, and as a marked stimulating, exciting diuretic. It escapes from the body by the kidneys.

Therapeutics.—Juniper is valuable as a stimulant to the genitourinary tract whenever it is depressed or chronically diseased, as in *chronic pyelitis, nephritis,* and *chronic catarrh of the bladder.* In *congestion of the kidneys,* particularly that due to feeble circulation, if not accompanied by active renal changes, it relieves these organs and does away with *albuminuria.* Used after an attack of *acute renal inflammation* when reaction has set in and the secreting epithelium of the kidney is atonic, it is of value; but care should be taken that all inflammation has passed by or it will make the patient worse. In the later stages of *scarlet fever,* in which the renal condition corresponds to that just described, juniper is also useful. In old persons a *sensation of weight across the lumbar region* is often quickly removed by the use of juniper if the kidneys are inactive.

Administration.—Juniper is used in the form of the compound spirit, no longer official, composed of the oils of juniper, caraway and fennel combined with alcohol and water, in the dose of 1 to 4 drams (4.0–16.0). Gin is virtually identical with the compound spirit. The infusion of juniper is made by adding 1 ounce (30.0) of the berries to a pint (480 cc.) of boiling water and allowing it to stand in a warm place for one hour. The entire quantity is to be taken in twenty-four hours. This infusion is often combined with 1 ounce (30.0) of acetate of potassium or of the bitartrate of potassium in the treatment of dropsy. The spirit (*Spiritus Juniperi,* B. P.) is given in the dose of 30 minims to 1 dram (2.0–4.0). B. P. dose, 5 to 20 minims (0.3–1.3). The oil (*Oleum Juniperi,* U. S. and B. P.) is used in the dose of 1 to 4 minims (0.06–0.25).

KAOLIN.

Kaolin (*Kaolinum,* U. S. and B. P.) is a soft white powder, a decomposition product containing feldspar. It is used externally as a dusting-powder in *eczema. Cataplasma Kaolini* (U. S.) is used as a poultice.

(For its use in Cholera see Cholera in Part IV.)

KINO.

Kino (U. S. and B. P.) is the inspissated juice of *Pterocarpus marsupium.* It contains kinotannic acid, and is used as an astringent in the treatment of *serous diarrhea.* It is official in the form of tincture (*Tinctura Kino,* U. S. and B. P.), and is given in the dose of 2 fluidrams (8.0), ½ to 1 fluidram (2.0–4.0), B. P. Kino may be used as a gargle in *sore-throat* and for *relaxation of the uvula.* Under the name of compound powder of kino (*Pulvis Kino Com-*

positus, B. P.), an efficient and pleasant *antidiarrhea* powder is used. This powder is not official in the U. S. P. The formula for each powder is 15 grains (1.0) of powdered kino, 4 (0.2) of powdered cinnamon, and 1 (0.06) of powdered opium.

LACTIC ACID BACILLUS AND BACILLUS ACIDOPHILUS.

Various strains of the lactic acid bacillus have been introduced into medicine during the last few years for a number of purposes, of which one of the most important is the control of intestinal putrefaction of proteids. Claims have been advanced to the effect that a panacea has been found for all digestive disorders, and that the universal disease, old age, can be postponed by the constant ingestion of these organisms, it being thought the changes of old age are caused in large part by the absorption into the blood stream of intestinal toxins. Like many other deductions of a sweeping character, this view has a small amount of truth as a basis for its existence. As a matter of fact, the internal use of lactic acid bacilli is of value in intestinal putrefaction only in those cases in which the decomposition of proteids is the chief condition, and their employment is of no value, and, indeed, may be worse than useless, in cases suffering from fermentation of the carbohydrates; a state often increased by the introduction of the lactic acid bacillus. (See below.)

A differentiation of these two conditions can be made in part by regulation of the diet and by several methods of examination. When proteids are undergoing putrefactive changes the stools are alkaline whereas, the starches, when fermenting, usually produce acid stools. Another method of differentiation is by means of Strasburger's fermentation apparatus. About 5 grams of feces are placed in the lower receptacle of this apparatus and the tube directly above filled with water. The whole apparatus is then exposed to a temperature of 100° F. for about twenty-four hours, and the amount of gas produced is calculated by the quantity of water forced into the third tube. If more than one-third of this tube is filled with water and if the feces give a distinctly acid reaction, it is fair to assume that the decomposition in the intestines is due to fermentation of carbohydrates, which contraindicates the use of the lactic acid bacillus.

The second method is to Gram-stain cover-glass preparations counterstained with neutral red. In healthy stools the Gram-negative organisms will be present in greatest numbers; the colon bacillus being Gram-negative; whereas, in the presence of putrefaction, the blue-stained organisms are in excess. In other words, when the blue-stained organisms are in excess, the administration of the lactic acid bacillus will probably produce advantageous results, and at the same time meats must be strictly excluded from the diet.

The explanation of the good results obtained by this plan of treatment lies in the fact that this bacillus produces lactic acid, which exercises a deleterious effect upon those organisms which fare badly in the presence of an acid medium, as, for example, the Bacillus coli, the spirillum of cholera, the streptococcus, the Bacillus typhosus, and others often found in the intestine.

In addition to their use in the states first named, the *Bacillus lactis* has been used in the treatment of those types of infantile *diarrhea* in which putrefactive changes are present in the bowels, and usually it is given to such patients in the form of diluted buttermilk. The Bacillus lactis is also used in cases of *rheumatoid arthritis,* in which state it is believed that septic or bacterial absorption from the bowel is responsible for the state of the joints.

In addition to their use internally, these organisms have been used locally to combat various septic states, such as slowly healing infected surfaces, sinuses, and even in infections due to the gonococcus, particularly the chronic types in women. One way of employing them is in the whey of milk curdled by their action. If the vaginal discharge is alkaline the commercial tablets, containing the bacillus in nearly pure culture, may be crushed and rubbed up into a powder with sugar of milk, which is then dusted over the parts affected after they have been thoroughly cleansed by saline solution, but not by antiseptic solutions which will destroy the Bacillus lactis.

The Bulgarian lactic acid bacillus (Bacillus Bulgaricus) is very largely used. It is put up in compressed tablets, and is given by the mouth the dose is 2 or 4 tablets after meals, followed by a little sugar or lactose to aid its growth. This is essential (see Buttermilk). These may be given powdered and mixed with water to infants. It is essential for the preservation of the bacillus that these tablets be kept in a refrigerator or other cool container. (See Cholera Infantum.)

It has been shown very surely by many careful investigators that it is impossible to implant the lactic acid bacillus in the large bowel where its action in combating the colon bacillus is most desired. On the other hand, the Bacillus acidophilus can be so implanted, provided it is given in very heavy dose far beyond the contents of any tablet. To be effective it must be given in milk which has been soured by its growth and which contains myriads of the organisms after fermenting from forty to fifty hours. About a pint to a quart of such milk is needed in divided doses in each twenty-four hours. Here again sugar or lactose should be given to aid the growth of the bacillus.

LANOLIN.

Lanolin is the *Adeps Lanæ Hydrosus,* U. S. and B. P., a fat containing not over 30 per cent of water derived from the wool of the common sheep, and is a whitish substance of peculiar stability, very difficult of saponification, and incapable of becoming rancid. Unna states that ointments of acids, hydrogen peroxide, and other substances may be made by it. One great objection to lanolin is its stickiness, which is avoided by adding one-third of vaseline. Lanolin is supposed to possess very remarkable penetrating powers when applied to the skin in cases where much infiltration is present, particularly if it is combined with resorcin or some similar medicament. In itself it has little curative power, and is but little better than lard, suet, or any common fat as a basis for ointments. In some rare cases it causes irritation of the skin. Adeps lanæ hydrosus has been used with success in the treatment of severe burns after the affected and surrounding parts have been properly cleaned. (See Burns, Part IV). A weak permanganate of potassium solution may be applied, blisters opened and dead skin or tissue cut away. The parts are next washed with sterile saline, dried with sterile gauze and then covered by compresses soaked in lanolin with 20 per cent of vaseline, the ointment being melted and sterilized by heat on a water-bath. Over the gauze compresses is placed sterile gauze and absorbent cotton. This treatment is repeated daily. If sloughs form these are removed at each dressing and the parts washed with permanganate and treated as at first. *Adeps Lanæ*, U. S., is anhydrous wool-fat.

LEAD.

Plumbum, or lead, is a metal possessing more or less influence over the organism according to the salts which are employed. It is not official as lead itself.

Physiological Action.—Lead, in one of its soluble salts, if applied to a mucous membrane, by reason of its astringent effect produces a blanching which is particularly noticeable where the blush of inflammation has previously been present. It has little effect when given in a single dose, except by an indirect influence over the circulation, nervous system, or respiration. (For a description of the effects of lead in overdoses see "Poisoning," below.)

The most irritant and poisonous of the soluble salts is the nitrate, the next the subacetate, and the least poisonous of the soluble salts is the acetate.

The insoluble salts rarely cause acute poisoning, but frequently produce chronic plumbism.

Acute Poisoning.—When the acetate of lead is taken in poisonous amounts it produces a sweet metallic taste in the mouth, followed by pain in the epigastrium and the vomiting of white, milky-looking liquids or white curds mixed with food. The white color is due to the presence of chloride of lead formed by the acid of the gastric juice.

The pain rapidly increases in severity, and diarrhea due to gastroenteritis may be set up, or, in other cases, obstinate constipation is present. The passages are generally *black*, this color being due to the presence of the sulphide of lead. At the same time the pulse becomes rapid, tense, and cord-like, but after a time weak and compressible. The face is anxious and pale or livid. The thirst is excessive and cramps in the calves of the legs or muscular twitchings may ensue. It is said that the blue line on the gums characteristic of chronic poisoning may occur in acute poisoning, but this is rarely, if ever, seen. If coma comes on in the course of acute lead poisoning, death is almost certain.

The treatment consists in the use of the chemical antidote, a soluble sulphate, in large quantity, in the administration of emetics, and the use of the stomach-pump if the vomiting produced by the drug is not sufficient to rid the stomach of all the poison. The best soluble sulphates to employ are Epsom and Glauber salts, because they are always at hand, are readily soluble, and, in excess, act as purges which will wash out the intestinal canal. Hot applications should be applied to the belly and feet, and the pain and irritation which are present should be relieved by opium.

Chronic Poisoning.—Chronic lead poisoning is rarely produced by the soluble salts of lead, nearly always being due to the insoluble salts. The symptoms of chronic lead poisoning, or plumbism, are as various as it is possible to find variety in the signs of disease of every kind. There is no train of symptoms which may not occur, and the occurrence of rare, anomalous symptoms in a given case should at once bring to the mind of the physician the thought of lead poisoning or syphilis. Chronic poisoning occurs in painters, manufacturers of lead salts, and every one who is largely brought in contact with the metal in the arts. It occurs from the use of hair-dyes containing the acetate of lead, from drinking water which has passed through new lead pipe, and even from the biting of silk threads weighted with salts of lead. Chromate of lead has been used to color sponge-cake when eggs were thought too expensive for the purpose, and has killed many persons. Millers who have filled the holes in mill stones with lead have caused wide-spread epidemics of what has been called "dry cholera," and many persons have suffered from lead poisoning from eating apple-butter kept in jars glazed with lead. An epidemic of subacute lead poisoning has followed the use of red pepper adulterated by red lead and from the use of snuff colored with lead chromate or wrapped in lead foil.

One of the most prominent, but by no means the most constant, symptoms of chronic plumbism is bilateral wrist-drop, due to palsy of the extensor muscles of the forearm. The short extensor of the thumb generally escapes the drug's influence, as does also the supinator longus. Foot-drop also occurs, and I am indebted to Dr. H. C. Baldwin, of Boston, for the accompanying illustration of this state.

Sometimes internal squint arises from paralysis of the external rectus muscles by the lead. Another very common symptom is severe colic centering around the umbilicus and radiating through the belly and loins. Obstinate constipation often accompanies these symptoms, and the feces, when passed, are white and clay-colored, owing to deficient secretion of bile. During an attack of lead colic the arterial tension is increased very markedly, the tongue is coated and whitish, and the bowels are obstinately confined.

If these early warnings are disregarded and the exposure to the lead is continued, cerebral symptoms may come on, the result of *encephalopathia saturnina,* or saturnine cerebritis. Saturnine epilepsy is now very rare. If convulsions come on, death generally ensues. The convulsions in some cases are not due to a cerebral effect of the lead, but to uremia due to the renal changes which it has caused.

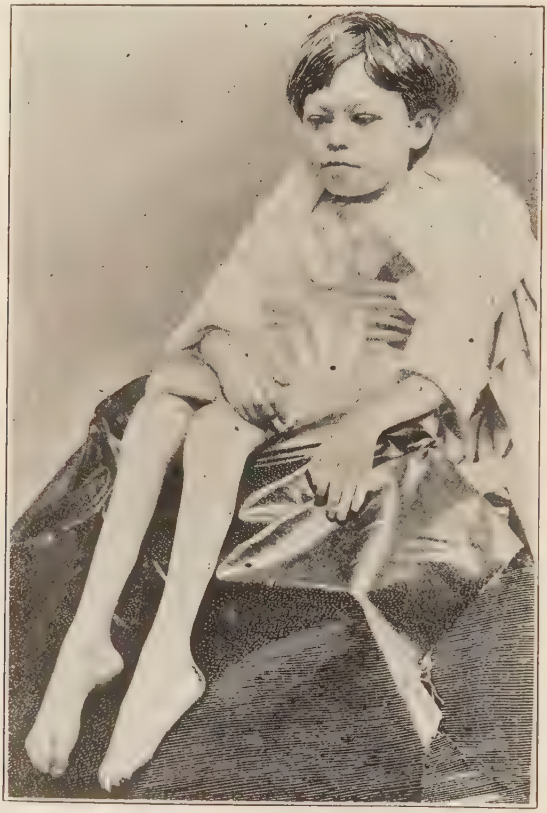

Fig. 54.—Drop-wrist and drop-ankle due to chronic lead poisoning. (Baldwin's case.)

Renal disease and arteriosclerosis are very commonly produced by lead, and it is not uncommon for chronic contracted kidney to be found at the autopsy of a sufferer from chronic lead poisoning. If a patient with chronic lead poisoning has a urine with a persistent low specific gravity the prognosis is grave, as evidencing advanced kidney involvement.

Asthma due to the inhalation of lead dust is sometimes met with.

The most important confirmatory evidence of chronic lead poisoning is a blue line on the gums just where they join the teeth. Its absence is not a negative sign, however, as poisoned persons cleanly in respect to their mouths often do not have it. This blue line is not, however, pathognomonic, as Oliver states that persons who have received large doses of bismuth by the mouth, or by injection into an empyema, may show a similar line. Basophilic degeneration of the red blood cells separates the two conditions. Marked cachexia or anemia is commonly seen in chronic lead poisoning, the so-called saturnine cachexia. Not only is basophilic degeneration of the red blood cells met with in chronic lead poisoning. McJunkin has shown that leukocytes and endothelial cells change inorganic lead into a compound soluble in albuminous liquids.

The blue line may appear early or late. Charteris reports a case in which it appeared after taking only 4 lead and opium pills. In another case it did not appear until after 128 grains had been ingested.

After prolonged lead poisoning the nerve trunks are found atrophied, and finally changed into fibrous cords. Anterior poliomyelitis may be present, but true locomotor ataxia is rarely caused. If ataxic symptoms exist, they are most probably dependent on pseudotabes produced by a plumbic multiple neuritis, which can be separated from true tabes dorsalis by the absence of several of the important true tabetic symptoms—such as slow onset, the Argyll-Robertson pupil, etc.—while the presence of marked wasting and loss of power, and sometimes tenderness over the nerve trunks, points to neuritis.

In some cases trophic changes in the joints ensue, and plumbic gout is not rarely seen, or even lead arthritis, with deposits of urates in the joints. This condition is due to the fact, pointed out by Garrod and Haig, that lead forms insoluble salts with uric acid.

Lead escapes from the body in the urine, the feces, and all secretions. It is chiefly eliminated by the liver in the bile.

TREATMENT OF CHRONIC POISONING.—The treatment consists in three classes of remedial measures: (1) The removal of the patient from exposure; (2) the fixation or removal of the poison in the body; (3) the treatment of the lesions produced by the poison.

In lead colic hepatic purges, such as jalap and calomel, combined with opium to prevent pain, are indicated, and alum and opium or morphine are said to be almost specifics, the alum in 2-grain doses, the others in full amounts. In many cases purges fail to move the bowels of a person suffering from chronic lead poisoning, and succeed only when morphine is given to overcome the intestinal inhibition produced by the irritation caused by the lead.

The matter of elimination is somewhat complex. In the presence of subacute lead poisoning, induced by exposure to lead, the body attempts to protect its vital tissues by storing the lead in the bones. If the symptoms are fairly severe it is best to give foods such as milk which contain relatively much calcium and also to administer 20 to 40 grains of calcium lactate a day since this aids in the storage of the lead in the bones. If the iodides, ammonium chloride, or parathyroid (see below) are freely used they may increase intoxication by setting free lead in the blood stream and preventing its storage in the bones. These agents are to be used only in old cases which have not been recently exposed or in whom the symptoms are not pressing. At this time no food with a high calcium content should be given and iodide of sodium which greatly aids in the elimination of lead by forming double soluble iodides may be used, but it should not be used in too large doses at first since if the lead is mobilized in large amounts it may precipitate an attack of acute lead intoxication. If it is cautiously increased from 10 to 15 grains three times a day and the patient does well it is advisable to push it in larger amounts. In place of the iodide, ammonium chloride in 30 to 60 grains (2.0 4.0) doses may be employed, probably changing the tertiary lead phosphate in the bones into secondary lead phosphate. So, too, parathyroid gland has a marked effect in eliminating lead in chronic cases, but as such doses cause a hypercalcemia and a great increase in calcium elimination, it should not be resorted to unless under control by estimations of the blood calcium. Further, such gland treatment markedly increases the non-protein nitrogen in the blood which is often abnormally high because of the contracted kidneys due to lead.

It is evident, therefore, that a carefully carried out determination of the stage of the intoxication is necessary if accurate therapeutic measures are to be instituted.

If progressive paralysis is present, Wood insisted on the use of large doses of strychnine at the same time that iodide is given. Strychnine sulphate should not, of course, be given in the same mixture as the iodide, as it is, chemically, incompatible.

Electricity should be used as a remedy to restore lost function. If the faradic current makes the muscles contract, it should be employed, and if not, the galvanic current should be used. Curiously enough, partial voluntary power sometimes returns before the muscles will react at all to electricity.

It is said that baths of sulphuret of potassium do good in chronic plumbism, 5 or 6 ounces (180.0) of the salt to each bath, which is to be given in a wooden or enamel tub. The patient should afterward be well soaped, then thoroughly rinsed off, and rubbed down with a rough towel.

As the salts of lead are used for different purposes, the therapeutics of each one will be taken up separately.

Acetate of Lead.

Acetate of lead (*Plumbi Acetas*, U. S. and B. P.), or sugar of lead, has a sweet, astringent taste, and is soluble in water, but the solution formed is slightly milky in appearance.

Therapeutics.—Acetate of lead may be used, and is largely employed in the following pill in the treatment of *serous diarrhea:*

℞—Plumbi acetatis	gr. xl (2.6)
Pulveris opii	gr. x (0.6)
Camphoræ	gr. xl (2.6).—M

Fiant pilulæ, No. xx.
S.—One every four hours.

This pill may also be given in cases of *dysentery.*

The acetate of lead in proportion of 1 to 8 grains (0.06–0.5) to the ounce of water may be used as an injection for *gonorrhea.*

Lead acetate is also a useful application for the *dermatitis* produced by poison ivy, as this drug precipitates the sticky, non-volatile oil of *Rhus toxicodendron,* studied by Pfaff. The acetate should be dissolved in alcohol in the proportion of ½ grain to the ounce (0.03–30.0) and used as a wash. After this the inflamed parts should be treated by cooling applications, but ointments are not to be used, as they dissolve the poisonous oil and spread the irritation.

The B. P. recognizes the following preparations of lead acetate: *Pilulæ Plumbi cum Opio,* dose 3 to 5 grains (0.2–0.3); *Suppositoria Plumbi Composita,* each suppository containing 1 grain (0.06) of opium to 3 grains (0.20) of lead acetate; and an ointment (*Unguentum Plumbi Acetatis*).

Carbonate of Lead.

Carbonate of lead (*Plumbi Carbonas,* B. P.), or white lead, is insoluble, and is used as a coating or dressing for *burns, scalds,* or *ulcers* when rubbed up with linseed or other oil, or in the form of the ointment (*Unguentum Plumbi Carbonatis,* B. P.). If an extensive surface is covered with this ointment, it may cause subacute lead poisoning by absorption.

Carbonate of lead may be used in the treatment of *sunburn* in the following prescription.

℞—Plumbi carbonatis	ʒj (4.0)
Pulveris amyli	ʒj (4.0)
Unguenti aquæ rosæ	℥j (30.0)
Olei olivæ	fʒij (8.0).—M.

S.—Apply to the inflamed skin.

Iodide of Lead.

Iodide of lead (*Plumbi Iodidum*) is occasionally employed in medicine; the dose is ½ to 2 grains (0.03–0.12). *Emplastrum Plumbi Iodidi,* B. P. and *Unguentum Plumbi Iodidi,* B. P., are used as external astringent and alterative applications, but are rarely useful.

Liquor Plumbi Subacetatis.

Liquor Plumbi Subacetatis, U. S., and *Liquor Plumbi Subacetatis Fortis,* B. P., or Goulard's extract, is a colorless liquid, much used externally, when diluted with laudanum, for *sprains, bruises,* and local inflammations, under the name of "lead water and laudanum." "L. and L.," as it is often called in the hospitals, is a useful application in the *dermatitis* produced by poison ivy. The proportion should be 4 parts of the undiluted lead water, diluted with 16 parts of water to 1 of laudanum, but this is varied as the inflammation or pain is the more severe. The dilute solution (*Liquor Plumbi Subacetatis Dilutus,* N. F. and B. P.), is too weak for ordinary use, although it is commonly employed. The strong solution should be used in the strength of from 1 to 4 ounces (30.0–120.0) to the pint (480 cc.) of water. This solution should never be employed if the skin is broken, as the drug prevents healing by constringing the edges of the wound.

If some bread-crumbs be saturated with the solution just named and applied to an inflamed finger, a *felon* can often be aborted in its early stages. The official dilute solution is useful as a lotion in *eczema* which itches and tingles and is not dry in character. It should be applied once or twice a day, and it is well to follow the application of lead with an alkaline wash. (See Eczema.)

Lead water is also useful in *pruritus pudendi.* The cerate (*Ceratum Plumbi Subacetatis, Unguentum Plumbi Subacetatis,* B. P.), and the glycerin (*Glycerinum Plumbi Subacetatis,* B. P.) may be used for the same purposes as Goulard's extract.

Lead acetate is used for the preparation of lead plaster (*Emplastrum Plumbi Oleatis,* U. S. and B. P.), sometimes called "diachylon plaster."

Hebra recommended for *sweating of the feet* an application of equal parts of lead plaster and linseed oil, applied on linen and wrapped around the feet every third day.

It is interesting to note that in England this plaster has been freely applied to produce abortion by the absorption of the lead with resulting poisoning.

Litharge.

Litharge (*Plumbi Monoxidum,* U. S. and B. P.) is used in the preparation of the solution of subacetate of lead.

LEVULOSE.

Levulose is a monosaccharide sweeter than cane sugar, and if pure, free from glucose. It is used in medicine as a substitute for cane sugar, a disaccharide, in the dietetic treatment of *diabetes* and *tuberculosis.* It is absorbed as levulose and is readily oxidized in the body. Levulose differs from other sugars in that it depends for its metabolism on the action of the liver. Upon its being absorbed from the stomach or bowel it is readily utilized by the liver if that organ is healthy. When given intravenously with rapidity much of it is carried directly to the kidneys and eliminated without the interposition of the liver function. If given by the mouth it may therefore be utilized as an efficient carbohydrate foodstuff, but is of less value if it is given by the needle into a vein. Because normal liver function is necessary for its storage levulose has been used to test the state of that viscus, since if about 45 grams are given by the mouth in 100 cc. of water, after eight hours starvation, the blood sugar rises scarcely at all because the liver metabolizes and stores it rapidly. On the other hand, if the liver is diseased, there is a sharp rise in the blood-sugar curve. This is notably present in acute and chronic hepatitis, hepatic cirrhosis, or cholangitis, and particularly in hepatic damage as after arsphenamine or chloroform. Given a healthy liver it is a readily assimilated carbohydrate when given by the mouth and is easily utilized by the body in *diabetes* so that it may be most useful in threatened, or present, diabetic coma particularly if insulin is employed. When given by the rectum the proportion is 1 ounce in 1000 cc. of water. (See Enteroclysis and Intravenous Injection, Part II, and Diabetes and Vomiting in Part IV.) Levulose may be taken by diabetic patients in place of cane sugar without injury in many instances, and tends to promote nutrition but in some cases it does no better than dextrose. It has also been used with advantage in poorly nourished children and by tuberculous persons whose digestion cannot cope with cane sugar.

LIQUORICE.

From *Glycyrrhiza,* U. S., and *Glycyrrhizæ Radix,* B. P., is made the solid extract which is used to increase secretion in the mouth and, when dissolved in water, to form a vehicle for other drugs. The powdered solid extract is a very mild and useful laxative.

Administration.—The solid extract (*Extractum Glycyrrhizæ,* U. S. and B. P.) is used in a dose varying from 5 to 120 grains (0.3–8.0). The pure extract (*Extractum Glycyrrhizæ Purum,* U. S.) is used in the same quantities as the ordinary extract. The fluidextract (*Fluidextractum Glycyrrhizæ,* U. S.) or the liquid extract (*Extractum Glycyrrhizæ Liquidum,* B. P.) is used in 1- to 2-dram (4.0–8.0) doses, and enters into the preparation of the elixir (*Elixir Glycyrrhizæ,* U. S.). Under the name of Brown Mixture, or "Compound Liquorice Mixture," a very efficient expectorant solution is official (*Mistura Glycyrrhizæ Composita,* U. S.), which contains as its most important ingredients in each dram 7 minims of paregoric, $\frac{1}{77}$ grain of tartar emetic, and $1\frac{3}{4}$ minims of sweet spirit of nitre. The dose of Brown Mixture is 1 to 4 drams (4.0–16.0). *Pulvis Glycyrrhizæ Compositus,* U. S., and B. P., or compound liquorice powder, contains, according to the U. S. P., 18 per cent of senna, 23.6 per cent of liquorice, 0.4 per cent of oil of fennel, 8 per cent of washed sulphur, and 50 per cent of sugar. According to the B. P. it should contain 2 parts of senna, 2 of liquorice root, 1 of fennel fruit, 1 of sublimed sulphur, and of sugar 6 parts. The dose is 1 to 4 drams (4.0–16.0). It is largely used as an efficient laxative after childbirth and in cases which suffer from constipation chiefly due to the inactivity consequent upon being in bed.

LIQUOR POTASSII HYDROXIDI.

Liquor Potassii Hydroxidi, U. S.; *Liquor Potassæ,* B. P., is a solution containing about 5 per cent of potassium hydroxide. It is used in medicine as an *antacid* and for the purpose of decreasing the *acidity of the urine.* Its dose is 5 to 30 minims (0.3–2.0) well diluted with water.

In cases of *ingrowing toe-nail* it is often used to soften the nail prior to packing with cotton, or partial evulsion.

LITHIUM.

Lithium is used in several forms, but its salts may be divided into two classes—those which act as lithium and those which act as the acids forming them. In the first class are the carbonate (*Lithii Carbonas,* N. F. and B. P.), dose 2 to 10 grains (0.12–0.6), 2 to 5 grains (0.12–0.3), B. P., the citrate (*Lithii Citras,* N. F. and B. P.), dose 5 to 20 grains (0.3–1.3), 5 to 10 grains (0.3–0.6), B. P. In the second class are *Lithii Bromidum,* N. F., dose 10 to 30 grains (0.6–2.0), and *Lithii Salicylas,* dose 10 to 30 grains (0.6–2.0).

The carbonate and citrate are used in *gout* and *rheumatoid arthritis* with the idea that they will enter into combination with the uric acid in the body to form soluble urates and prevent deposits in the joints. Haig has pointed out that although lithium forms salts with uric acid in the test-tube, in the body they have a greater affinity for the acid sodium phosphate in the blood, and practically leave the uric acid to itself. This is an important point, since it proves that the large amount of water generally taken with lithium salts has more to do with relieving gout than has the lithia. The carbonate is not soluble in water, and should be given in capsule or freshly made pill, but the citrate is soluble.

It is worthy of note that in some cases citrate of lithium will disorder the stomach and produce vomiting; and overdoses produced general relaxation of the system with a sense of feebleness.

(For the use of other salts of lithium see the articles on the Bromides, Salicylic Acid, and Benzoic Acid. See also article on Mineral Springs.)

LOBELIA.

Lobelia, U. S. and B. P., contains an alkaloid, lobeline and lobelic acid.

Physiological Action.—When taken in poisonous dose lobelia causes emesis, intense prostration, a feeble pulse, pale skin, livid face, muscular relaxation and a cold sweat. Violent purging may be present. Ultimately it paralyzes the respiratory center and the peripheral vagi. The treatment of the poisoning is to administer opium to allay irritation and check vomiting, to give alcohol and ammonia to support the heart, and the use of external heat. In relatively small dose it stimulates the respiratory center. Under the name of alpha-lobelin a derivative has been given hypodermically for this purpose.

Therapeutics.—Lobelia is used chiefly as an *antiasthmatic*, and has been equally praised and condemned by eminent authorities. The reason for this lies in the fact that it is often useless in *asthma* unless given in almost poisonous dose. Wood taught that it should never be used, because of its poisonous effects even in doses medicinally active, while Sydney Ringer stated that the drug is erroneously thought to be dangerous. In *asthma* both of the gastric and bronchial form lobelia is undoubtedly of service. In some cases it fails as signally as it succeeds in others. If the asthma is due to or associated with cardiac disease, lobelia should never be employed. The drug should be taken in the dose of ½ dram (2.0) to 1 dram (4.0) of the tincture at the first sign of an attack, or in 10-minim (0.6) doses every fifteen minutes until distinct nausea occurs or relief is obtained. If the heart is feeble, its use is contraindicated.

In *atonic constipation* with great dryness of the feces 10 minims (0.6) of the tincture of lobelia at bedtime are often of service, particularly if it is combined with cascara sagrada. (See Cascara Sagrada.)

Alpha lobelin has been used to combat respiratory depression during anesthesia, in *carbon monoxide poisoning* and in *asphyxia neonatorum* and is best given hypodermically or intramuscularly, but Curtis and Wright have shown that it is a cardiac depressant and contraindicated in the presence of myocarditis and feeble heart. In other words, while it is true that pharmacological experiments support the view that alpha lobelin is a stimulant to the respiratory center, nevertheless, as Marshall well says, "the toxicity of the drug is so great that its extensive clinical use is inadvisable if not actually dangerous." It has failed in bedside practice in most instances. It has been found of value in cases of *hiccough*.

Administration.—Lobelia is given in the form of the tincture (*Tinctura Lobeliæ*, U. S.), in the dose of 10 to 60 minims (0.6–4.0) as a sedative, or 2 to 4 drams (8.0–16.0) as an emetic. The vinegar (*Acetum Lobeliæ*) is no longer official, but is given in the dose of 20 to 30 minims (1.3–2.0), and the fluidextract (*Fluidextractum Lobeliæ*, N. F.) in the dose of 1 to 5 minims (0.06–0.3), or as an emetic in the dose of 15 minims (1.0). Alpha-lobelin appears on the market in 1 cc. ampoules containing a sterile solution of $\frac{1}{20}$ grain (0.003) and $\frac{3}{20}$ grain (0.009). The smaller dose is given intramuscularly in infants and the larger one to adults.

In the form of the infusion lobelia is useful as a lotion in the treatment of the *dermatitis* produced by poison ivy. The proportion used should be an ounce (30.0) to the pint (480 cc.) of water.

The preparation of the B. P. is *Tinctura Lobeliæ Ætherea,* dose 5 to 15 minims (0.3–1.0).

LUETIN.

Luetin is made from cultures of the spirochete of syphilis according to a process devised by Noguchi and is used for diagnostic purposes only. Furthermore it is of value only in the later stages of syphilis, never producing a reaction which is positive in primary syphilis (or in healthy persons), usually negative in secondary syphilis, but said to be 100 per cent positive in tertiary syphilis. It is noteworthy that in normal persons who are taking iodides or bromides, or have been taking these drugs recently, a positive reaction may ensue.

The method of use consists in its introduction intradermally, not subcutaneously, by means of a very fine needle and syringe, after the surface has been made aseptic with alcohol. The dose is 0.035 diluted with 0.035 cc. of sterile normal salt solution and is usually given in the skin of the arm. The injection naturally results in a small area of induration or erythema which disappears in forty-eight hours. Rarely a small papule appears. If the patient is in the later stages of syphilis positive reactions are developed in several forms as follows:

1. A large, varied, indurated *red papule* about 2 to 4 inches in diameter appears in twenty-four to forty-eight hours. The area involved gradually increases in size for three to four days and then begins to decrease, becoming dark red, the whole effect lasting rarely more than one week. This reaction is met in the early part of the late stages unless the patient has been taking active antisyphilitic treatment with mercury.

2. In this reaction the papulous form becomes more marked, and at the fourth or fifth day vesiculation and later pustulation develops, followed by rupture and temporary induration. No scar ensues.

3. An aberrant form, called the "torpid type," at first acts as if the test was negative, but after eight or ten days the point of inoculation lights up and proceeds to the formation of a pustule. It is evident therefore that the physician should wait for two weeks before deciding that the test is negative.

A point of importance is that a late syphilitic whose blood and spinal fluid gives a negative Wassermann will nevertheless give a positive luetin test. As pointed out in the article on arsphenamine a positive Wassermann test does not necessarily indicate treatment and a positive leutin still less, because it does not essentially indicate that the syphilitic process is actively present, but rather that the patient may be in the late stages or that he has had syphilis at some remote time in his life.

LUMINAL.

(See PHENOBARBITAL.)

LYCOPODIUM.

Lycopodium, U. S., occurs as a pale yellow powder. It is used by pharmacists as a powder in which to roll pills, and by physicians and nurses to prevent the *intertrigo* or *chapping of the skin* of infants and adults.

LYSOL.

Lysol is a preparation made by dissolving in fat and saponifying with alcohol that part of tar oil which boils between 190° and 200° C., and is a brownish, clear, oily fluid, smelling somewhat like creosote. It is used for the same antiseptic purposes as creolin (see Creolin), but possesses the advantage of forming a clear, soapy fluid when mixed with water, in which instruments can be seen. If small instruments are used, the solution is so soapy that it renders them too slippery for ready use. Those who have used lysol claim that it does not affect the skin of the operator's hands except to render it soft and flexible. Used upon mucous membranes, a solution of lysol should not be stronger than 2 per cent. As a gargle for *septic sore-throat* a 1 per cent solution may be used. *Liquor Cresolis Compositus,* U. S., is similar to lysol. Lysol is much less poisonous than phenol, but a considerable number of cases of poisoning by it have been reported.

MAGNESIUM.

Magnesium is a metal never used as such, but always in the form of one of its salts, which are the sulphate, citrate, carbonate, and sulphite. The sulphite is a natural salt found in sea-water and in caves or in the water coming from the latter. The citrate and carbonate are derived from the sulphate. The carbonate is insoluble in water and alcohol. The others are soluble.

Magnesium Carbonate.

The carbonate of magnesium (*Magnesii Carbonas,* U. S.) is a mixture of hydrated magnesium carbonate and magnesium hydroxide. It may be used intrachangeably with magnesium oxide (which see) for internal medication and is used as a dusting powder in *intertrigo.*

In *sick headaches* due to excessive *gastric acidity* carbonate of magnesium is often of service. The dose of the carbonate is from 5 to 60 grains (0.3–4.0). It should not be used constantly, as there is danger that it will accumulate in the intestines.

Magnesium carbonate, by increasing the coagulability of the blood, may be used in *hemophilia,* and it is often of value in *urticaria.* (See Calcium Chloride.)

Liquor Magnesii Bicarbonatis, B. P., is given in the dose of 1 to 2 ounces (30.0–60.0) as a laxative.

Magnesium Citrate.

The citrate of magnesium (*Magnesii Citras*) is a more irritating purge than the sulphate, but it is more agreeable to the taste. It is official as *Liquor Magnesii Citratis,* U. S., which is effervescent and should never be used unless freshly prepared. It is made by adding bicarbonate of potassium or sodium to a syrupy solution of the citrate of magnesium containing an excess of acid, and corking the bottle tightly, the cork being tied down with a strong cord. Care should be taken that the bottle is a strong one, as the development of large amounts of carbonic acid gas may burst it if it be weak. The dose is ½ to 1 bottle, which contains about 12 ounces (360 cc.). It is too irritating to be used when inflammation of the alimentary canal exists, but is useful in acute constipation and in *sick* and *bilious headache.*

The effervescent citrate (*Magnesii Citras Effervescens*) is less agreeable to take than the solution just named. It should be dissolved in water, about 1 to 3 drams (4.0–12.0) of the salt being used in each dose, and swallowed while the solution is effervescing. It must be kept in bottles tightly corked.

Magnesium Oxide.

Magnesia is the oxide of magnesium (MgO) (*Magnesii Oxidum,* U. S.). It is used in the form of the light magnesia (*Magnesia Levis,* B. P.) as a dusting powder. The troches (*Trochisci Magnesiæ*) each contain 3 grains (0.2). *Magnesii Oxidum Ponderosum,* U. S., is official in the B. P. as *Magnesia Ponderosa.*

Magnesia is an antidote to arsenic, and when employed to precipitate a soluble preparation of iron it forms the "*Antidotum Arsenici*" (*Ferri Hydroxidum cum Magnesii Oxido,* U. S.). (See Arsenic.)

It is important that the student should not confuse magnesia and magnesium. The first is the oxide of the second, and is sometimes called calcined magnesia, but magnesia and the carbonate of magnesium may be used interchangeably.

"Milk of Magnesia" (*Magma magnesiæ,* U. S.) is a liquid preparation of magnesium hydroxide $Mg(OH_2)$ which is deservedly popular and pleasant. It is an aqueous mixture which, by skilful pharmaceutical processes, is nearly stable. Added to milk it is superior to lime water as a neutralizing agent and has no taste. Only a dram is needed to equal many drams of lime water. It is used as a gentle laxative, which is increased in effectiveness if it be followed by a little orange-juice, and to correct *gastric irritability* and *acidity* in both adults and children. It is also used as a *mouth-wash* to neutralize acids and to protect the teeth. The dose varies from a teaspoonful to a tablespoonful, which may or may not be diluted with water.

Magnesium oxide has the advantage over sodium bicarbonate in the relief of *gastric acidity*, in that it has five times the neutralizing power and does not cause gastric distension from gas.

Magnesium Sulphate.

Sulphate of magnesium (*Magnesii Sulphas*, U. S. and B. P.) is a very soluble white granular powder of neutral reaction and salty taste, and is soluble in water. It is generally known as "salts," although in some parts of the United States this term also includes the sulphate of sodium and "Rochelle salt" or the tartrate of sodium and potassium. The popular name of it is Epsom salts.

Sulphate of magnesium is a purge by reason of its abstraction of water from the intestinal bloodvessels, because it stimulates peristalsis directly and by reason of the fact that solutions of it are not readily absorbed. As a result of these three factors free passages are produced, the bowel being filled by the water of the original solution and the liquid poured out by the bowel wall. All strong saline solutions, above the strength of 9 per 1000, abstract liquids from the tissues when brought in contact with them, and therefore whenever a thorough purgative action is required—that is, where depletion of the intestine or absorption of transudations is to be attained—the magnesium should be given in concentrated form, so as to make its solution as of high a percentage as possible.

In cases of *dropsy* the use of concentrated solutions is particularly necessary if free watery evacuations are desired, and from 1 to 2 ounces should be given before breakfast or on an empty stomach in as little water as will dissolve the salt. (See Dropsy.) Generally it is better to give this quantity divided into small doses every fifteen minutes until it is all taken. These concentrated solutions are safe if the tissues are water-logged, but dangerous if they are not. (See Poisoning.) The free use of magnesium sulphate in saturated solution is recommended in cases of *injury to the cranial contents* and in cases of brain tumor in order to diminish intracranial pressure by purgation. It is a dangerous treatment if there has been great loss of blood or if increased pressure is not actually present.

It is useful in the treatment of *bacillary dysentery*. When used for the latter purpose it should be given in dram (4.0) doses of a saturated solution with 10 to 15 drops (0.6 1.0) of aromatic sulphuric acid in water every two hours. The sulphate is not irritating, and may be given freely when inflammation exists. (See Dysentery, Part IV.)

Magnesium sulphate forms a large part of most of the natural purgative waters, but in them is present in very dilute form. These waters act partly by supplying the contents of the bowel with fluid and thereby softening the feces, the solution not being absorbed because of the salt contained in it.

Sometimes severe attacks of renal pain occur in middle-aged persons who have frequent attacks of *gravel,* and the urine will be found to contain octahedral crystals of calcium oxalate. A useful treatment is to give ½ to 1 dram (2.0–4.0) of magnesium sulphate with equal parts of citrate of potassium twice or thrice a day, in water, for a considerable period of time.

Magnesium sulphate may be given by enema with the double purpose of unloading the bowels and acting as a depletant. The best mixture for this purpose seems to be that of Watkins—namely, 2 ounces (60.0) of magnesium sulphate, 1 ounce (30.0) of glycerin, and 4 ounces (120.0) of water.

The B. P. contains an official preparation called *Magnesii Sulphas Effervescens,* which is granulated, and is given by the mouth in the dose of 4 to 8 drams (16.0–32.0).

Clinical experience indicates that this salt in 50 per cent strength and in the hypodermic dose of 2 cc. will often act as an efficient sedative over the space of several hours. The safe dose lies between 1 to 2 cc. per 10 kilograms of body weight. Such a dose may be given to overcome restlessness in the so-called "twilight sleep" in labor but some doubt has been thrown upon its efficiency for this purpose. The solution should be made of the pure salt and be sterile. Morphine when dissolved in a 25 per cent solution (30 minims) is supposed to have its effects increased. This is a mooted point.

Tucker has shown that magnesium sulphate acts as a powerful *pain reliever* and local anesthetic if applied locally in saturated solution by means of compresses. For this purpose it may be applied over the scrotum in *orchitis* and over *neuralgic nerves.* I have relieved the pain of *neuritis* in the foot by placing a circular compress wet with magnesium sulphate about the leg. Used in this manner it is also an excellent remedy for *erysipelas* and to relieve the pain of *acute inflammatory rheumatism.* In the World War a saturated solution proved an excellent dressing for *wounds infected by streptococci,* as it inhibits their growth. The efficacy of the solution is increased if 10 per cent of glycerin is added to the solution. This also keeps the dressing moist. In the absence of ordinary remedies a 25 per cent solution is an efficient dressing for *burns* and *scalds* and such a solution, or even a saturated solution, is a useful dressing for the *dermatitis of poison ivy.*

Meltzer and others have shown that the injection of magnesium sulphate solution into the subarachnoid space by the intraspinal method (see Procaine) aids materially in controlling the spasms of *tetanus* and often causes sleep, although, of course, it does not cure. Meltzer used by intraspinal injection 1 cc. of a 25 per cent solution in water to each 20 pounds of body weight of the patient. The patient if in severe convulsions should be chloroformed before the injection, and the head should be kept up so that the solution will not find its way toward the vital centers. As a rule, the relaxation of the muscles lasts about twenty-four hours, after which the injection is to be repeated in smaller dose and before the symptoms of the disease return in full vigor. This second dose is about 0.8 cc. per 20 pounds. Should the injection of the solution result in threatened respiratory failure, another puncture should be performed, some of the spinal fluid withdrawn and replaced by normal salt solution (see Procaine for method, Part II), which is no sooner injected than it is allowed to escape, and fresh saline injected to get rid of or dilute the magnesium solution. Meltzer also advised that the 25 per cent magnesium sulphate solution should be given hypodermically three or four times a day in the dose of 1 to 2 cc. and even goes so far as to advise in very urgent cases the intravenous injection of a 6 per cent solution at the rate of 2 or 3 cc. per minute until the symptoms are alleviated or the respiration begins to be depressed. Small amounts of calcium chloride solution in the strength of 2.5 per cent may be given intravenously if the magnesium causes respiratory difficulty. A dose of 0.2 gram per kilogram of body weight in 10 per cent solution has also been used intramuscularly in *tetanus neonatorum* with good symptomatic results.

Excellent results in controlling *eclamptic convulsions* have been obtained by the intravenous injection of from 10 to 20 cc. of a 10 per cent magnesium sulphate solution. Exactly how it acts is not understood and will not be until we know the cause of eclampsia. It is contraindicated if the respirations are feeble and if when given the respiration is depressed it is to be antidoted by the intravenous use of calcium chloride 5 cc. of a 5 to 10 per cent solution. Magnesium sulphate intravenously has been resorted to lower intracranial pressure in cases of *brain tumor* and cerebral injury. (See Intravenous Injection.)

Poisoning.—Very rarely, when concentrated solutions are given to persons who are not dropsical, the drug is absorbed, does not purge, and produces systemic poisoning, particularly if the patient has been deprived of fluid as in severe diabetes or after excessive vomiting. Death may occur, preceded by suppression of urine, toxic convulsions followed by paralysis in some cases and not rarely severe vomiting. Autopsy reveals patches of redness in the alimentary canal and an excess of fluid in the abdominal and other serous cavities. The treatment consists in the intravenous injection of large amounts of salt solution to dilute the magnesium concentration in the tissues and blood. The salt solution may be a little less than normal, that is, 0.6 per cent, instead of 0.9 per cent. When the magnesium is diluted the kidneys can eliminate it, which they fail to do if it is in concentrated form.

MANGANESE.

Manganum, or manganese, appears in the form of the black oxide (*Mangani Dioxidum Præcipitatum*). Under the name binoxide of manganese, it has been highly praised in *amenorrhea* dependent upon functional disturbance and *anemia*. The dose is 3 to 5 grains (0.2–0.3) three times a day, in pill form, and the drug should be taken for a few days before the expected or proper date for menstruation. The sulphate is rarely if ever employed, but may be tried in *malarial jaundice*. The dose is 1 to 2 grains (0.06–0.12).

MANNA.

Manna, U. S., is the concrete saccharine exudation of *Fraxinus ornus*, a tree of Europe. It occurs in roundish masses of varying size, looking somewhat like a gray-colored gum arabic. It has a sweet taste and odor. Sometimes the taste is a little bitter.

Therapeutics.—Manna is the most feeble of the laxatives, and causes slight flatulence in some persons. In children fed by the bottle one of the most frequent disorders in *obstinate constipation*, and for its relief 1 to 2 drams (4.0–8.0) of the sweet variety of manna may be dissolved in the milk of each bottle. When given to older children or adults, manna is always combined with other more powerful drugs, chiefly to disguise their taste. It may be combined with advantage with rhubarb and senna, and it enters into the official *Infusum Sennæ Compositum*, U. S., the dose of which is from 1 to 4 fluidounces (30.0–120.0).

MENTHOL.

(See Peppermint.)

MERCUROCHROME-220 SOLUBLE.

This is the disodium salt of dibrom-oxymercuri-fluorescein and occurs as iridescent green scales or granules which readily dissolve in water forming a dark red fluid. It contains about 23 per cent of mercury, and is said not to be irritating to mucous membranes. Unless kept in dark bottles its solutions should be freshly prepared.

The chief use of mercurochrome-220 is as a substitute for iodine as an antiseptic, with the advantage that it does not act as an irritant, but it has been shown not to be as efficient as iodine tincture. When used in place of iodine to sterilize an unbroken area of the skin prior to operation, the following formula should be employed:

Dissolve 2 grams of mercurochrome in 35 cc. of distilled water, add 55 cc. of 95 per cent alcohol and 10 cc. of acetone. Solutions forty-six days old have been found to be completely germicidal on two-minute skin tests, so that stock solutions may be made. This solution should not be applied to a broken surface or to a mucous membrane.

This solution is painless, does not cause dermatitis, is non-toxic, and its color demonstrates definitely the extent and the thoroughness of the preparation of the field. A disadvantage is its intense staining of tissues or fabrics. (See below.)

Mercurochrome-220 is used by urethral injection in the early stage of *gonorrhea* in 0.25 per cent solution every few hours, about 1 dram of the solution being introduced. Later the solution may be 1 per cent. For use in the posterior urethra the parts should be first washed by the use of warm sterile water and ½ to 1 ounce of a 1 per cent solution injected. *Chancroid* may be likewise treated by applying gauze soaked in 1 per cent solution. *Infected wounds* may be irrigated with a 2 per cent solution. As the 2 per cent solution as marketed causes much pain when dropped in the nose for *coryza* and *pharyngitis* it should be diluted at least one-half.

Mercurochrome has been used with some success in cases of bacteriemia, particularly when due to the staphylococcus in *puerperal sepsis.* (See Puerperal Diseases, Part IV.) It has been given intravenously in 1 per cent solution in 25 cc. of distilled water to a woman of 120 pounds, with 5 additional cc. for each 10 pounds over 120. It should not be dissolved in normal saline solution and the solution should not be boiled. When so used all the secretions, even to tears, are stained red, and the injection is followed by a severe reaction consisting in a rigor, high fever and an active diarrhea, which must be controlled by full doses of bismuth and opium. A second dose should not be given for several days. It would appear that mercurochrome is of great value in *persistent malarial infection.* Cases are reported in which one intravenous injection has cleared the blood of all parasites. The effective dose is about 0.003 per kilo of body weight in a 1 per cent solution. (See Intravenous Injection, Part III.) Its use is contraindicated if the kidneys are diseased, as it produces anuria. (See below.)

As experience increases it is becoming more and more evident that the free intravenous use of this drug in large doses is dangerous and perhaps futile, since autopsies have shown that it may cause severe changes in the kidneys and in the colon, resembling those due to bichloride of mercury.

It would also appear that such effects not only follow the practice of using too large doses which poison the patient but, by destroying many cocci at once a mass of endotoxin is set free. A safer method is to use small amounts, the endeavor being to exercise a bacteriostatic effect rather than one of bacteriolysis. It is probably safer to give 5 cc. of a 1 per cent solution every few hours or even 5 cc. of 0.5 per cent if the first injection is followed by a severe reaction. Even smaller doses may be advisable. The greater the infection of the blood the less the single dose for the above reason. Thus in one desperate case reported by Kilduffe, only 17 cc. of a weak solution containing only 0.11 grams of mercurochrome in all were given at irregular intervals over a period of five days with excellent results.

Colebrook and R. Hare[1] find that mercurochrome added to human defibrinated blood outside the body does not increase the bactericidal power of such blood and that its intravenous injection also fails in increasing its bactericidal effect if the blood be tested shortly after its use. They further seem to prove that no special antiseptic power is conferred upon the bile by intravenous injection. (See Intravenous Injections, Part III.)

To remove the stain from the hands immerse in a 2 per cent solution of potassium permanganate followed by a 5 per cent solution of oxalic acid. Carrel-Dakin solution may be so used, and for stains of fabric Labarraque's solution, acidifying, after soaking, with acetic acid or vinegar.

This drug is marketed in 2 per cent solution and in tablets of 4.6 grain, 1 tablet in 1 ounce of water making a 1 per cent solution.

Mercurochrome-220 as it appears in 2 per cent solution on the market may be used intravenously, but the manufacturers prepare a special product for this purpose put up in sealed tubes holding 0.5 gram the contents of which are to be added to 50 cc. of freshly distilled water. The solution is to be warmed, not boiled, before injection. If boiled mercury is precipitated.

MERCUROSAL.

Mercurosal is a derivative of acetyl-salicylic acid and mercuric acetate, its chemical name being disodium-mercuri-salicyl acetate. It appears as a slightly yellow-white powder freely soluble in water, which gives an alkaline reaction. It contains about 43 per cent of metallic mercury by weight. Because of its bland and unirritating qualities and comparative lack of poisonous properties inherent to mercury bichloride it can be brought in contact with tissues with no evil effect, the more so as when injected into the blood stream it does not cause clotting or local irritation. This holds true of intramuscular injections as well. Its therapeutic uses are identical with those salts of mercury which are generally used in the treatment of *syphilis*. Like all of them, it is contraindicated in the presence of nephritis.

Mercurosal is on the market in ampoules of 0.1 gram for intravenous use. The rate of dosage is usually every second day for 10 to 20 doses, and repeated in a month to six weeks. Often it is wise to give arsphenamine two weeks after the mercurosal injections are completed. It is to be noted that the intravenous dose is larger than the intramuscular dose.

MERCURY.

Hydrargyrum, U. S. and B. P., mercury or quicksilver, is a heavy fluid metal of a peculiar color and appearance. As metallic mercury

[1] British Journal of Experimental Pathology, April, 1827.

it is used in medicine in the form of the ointments, gray powder, blue mass, the unofficial gray oil, and plaster.

Physiological Action.—When mercury is taken into the body in one of its insoluble and mild preparations it may cause no evidence of its presence until by frequent and excessive dosage the system in general begins to feel its influence. The first evidences of this are to be found in the mouth, and consist in tenderness of the teeth when the jaws are firmly and quickly closed, fetid breath, sponginess of the gums, which finally may bleed at the slightest touch, swelling of the tongue, and most prominent of all, excessive salivation, a condition sometimes called ptyalism. (For treatment see Sodium Thiosulphate.) If the use of the drug is persisted in all these symptoms grow worse. Eczema and, finally, sloughs of the chin and chest develop as the result of the constant dribbling of saliva and the direct depressing effect of the drug on the tissues. The teeth drop out, the maxillary bones undergo necrosis, and amid a general melting down and deterioration of the tissues the patient dies. The blood is affected and becomes very thin, fluid and poor in its corpuscular elements. These symptoms ensue on the use of mercury in continued overdoses, and rarely follow exposure to the drug in the processes of the arts.

Children under three years are rarely salivated by the use of mercury, but this is no reason for using this drug carelessly in this class of cases, since the other changes in the organism nevertheless occur.

In the making of looking-glasses, barometers, detonators and felt hats, workmen are often affected by symptoms varying very widely in their course. In some cases the nervous system becomes chiefly affected. Tremors of all sorts arise, paralysis agitans is developed, and the results of peripheral neuritis ensue; but it is worthy of note that the ocular muscles are rarely involved in mercurial tremor, while in disseminated sclerosis nystagmus is not rare. Similarly the tremors of mercurial poisoning often affect the head and neck alone, while in paralysis agitans this is rarely the case. Chorea often comes on in chronic mercurial poisoning, and the occurrence of choreic movements in an adult should cause inquiry as to any possible exposure to mercury. In other cases brownish discoloration of the skin, resembling Addison's disease, appears. Blindness, deafness, sensory disturbances, such as hyperesthesia and anesthesia, may be developed, and localized wasting of muscles or groups of muscles may assert itself. In still other cases the blood becomes impoverished and mercurial cachexia is developed.

With the increasing use of mercury in electrical operations, it has been found that a new form of chronic mercurial poisoning arises. Investigations by the U. S. Public Health Service have shown that daily exposure to an atmosphere containing as small a quantity as 0.02 milligram of mercury per cubic foot of air results in signs and symptoms of poisoning. Daily exposure must continue for two to three months, or more, before symptoms appear, and in exposure to the above quantities of mercury for three to five hours daily there is a total daily absorption of mercury ranging from 0.771 to 1.285 milligrams, according to the duration of exposure.

The objective symptoms of this form of chronic mercurialism are manifested by a copper-colored discoloration of the mucous membrane of the pharynx, the pillars of the fauces, and the gums. This discoloration is constant in all cases, and should not be confused with infective inflammatory processes, which it somewhat resembles. The gums are swollen, and there is enlargement of the capillaries. Superficial erosions appear upon the mucous membrane of the gums and upon the buccal mucous membrane in the vicinity of the upper molar teeth. Perialveolar abscesses frequently occur and cause considerable discomfort. Occasionally there is an appreciable increase in the flow of saliva. Urine analysis and differential blood counts show the urine and the blood to be unaffected by the mercury absorbed. Subjective symptoms are characterized by tenderness of the gums and hypersensitiveness of the teeth, particularly those containing amalgam fillings. Activity of intestinal peristalsis is slightly increased, occasionally developing into mild attacks of diarrhea. Obstinate constipation is developed during absence from exposure for one to two weeks. Gastro-intestinal disturbance is manifested by pain due to accumulation of gas; there is often distention and feeling of weight in the hypogastric and iliac regions. As already mentioned, there are occasional attacks of diarrhea. Shifting neuralgic pains are occasionally felt in the various joints and in the chest.

ABSORPTION AND ELIMINATION.—The rapidity of absorption and elimination of mercury depends to a great extent on the variety of it which is given. The drug in some forms is so insoluble that great delay in its elimination must often ensue because it is slowly absorbed. Several opinions are held as to the form in which mercury is absorbed. It is usually taught in France that the theory of Miahl is correct; this is, that the mercurial preparations are transformed in the stomach and intestine into the bichloride, which in turn unites with the sodium chloride in the blood and circulates as a double chloride of mercury and sodium. In Germany it is taught that it forms an albuminate of mercury and so circulates (Henoch's theory), or that it forms a chloro-albuminate (Voit's theory). All these theories as to its absorption are open to grave criticism. As to the elimination of mercury, it is known to escape as an albuminate by every excretion of the body—the urine, feces, sweat, tears, milk, and saliva. After a single dose the drug begins to be eliminated in about two hours according to Byasson, and it is entirely gotten rid of in twenty-four hours. If, however, the doses are repeated, it gradually accumulates in the body, and is so slowly eliminated as to remain for almost indefinite periods of time, and is found deposited in all the organs. In other words, the doses of mercury ordinarily given are always large enough to produce cumulative effects. Thus while Balzer and Klumpke agree with Byasson as to the rapidity of elimination of a single dose, they find from an experimental study that the amount of mercury which can be eliminated by the kidneys for many weeks when the body is saturated with the drug is only $\frac{1}{16}$ grain a day. It is evident, therefore, that after a full mercurial effect is produced it is well to decrease, as do most syphilographers, the dose of mercury and give only sufficient to maintain the effect. It is also evident that the plan of using iodide of potassium every now and again to aid in the elimination of the residual mercury is advisable.

Contraindications.—Acute or subacute inflammation of the kidneys renders the continuous use of mercurial preparations dangerous and they should be used cautiously if continued for any length of time in all cases of renal disease, as mercury is a renal poison. The state of the kidneys should always be carefully investigated before the mercury is pushed.

Therapeutics.—The employment of mercury in medicine centers around three great points—viz.: (1), its value in *syphilis;* (2), its use as a *purge;* (3), its power as an *antiseptic* and *germicide.* The first function is fulfilled by all the mercury salts more or less perfectly, the second only by blue mass and calomel, and the third by the bichloride and biniodide of mercury.

As an Antisyphilitic.—In *syphilis* mercury is to be given, not because the patient is in this or that stage of the disease, but because it destroys the *Treponema pallida.* It is not as powerful in destroying the parasite as the arsenicals. Given in the same manner, mercury is more toxic to the patient in respect to its efficiency as a destroyer of the parasite of syphilis than is arsphenamine. Unless given intravenously, however, its absorption is so slow that its actual toxicity is diminished. Thus the toxicity for a rabbit of arsphenamine is 100 milligrams per kilo, but the spirillicidal quantity is only 10 milligrams per kilo. The toxic dose of neoarsphenamine is 300 milligrams per kilo and the needed dose is only 20 milligrams per kilo, whereas the toxic dose of mercury is 4 milligrams and the efficient dose about 3 milligrams. Aside from slow absorption, therefore, mercury has a margin of safety of only 1 point as against 90 for arsphenamine and 280 for neoarsphenamine. Many writers have insisted that it ought to be employed only in the secondary stages, and while this is, as a general rule, correct, certain conditions may call for it at any time. It is certainly of value in the tertiary stage.

The introduction of arsphenamine has in no way displaced mercury as an essential part of the treatment of syphilis. The best results are obtained by use of both. (See paragraph 8, p. 132, under Arsphenamine.) First the arsphenamine, then a course of mercury. The use of both drugs is well illustrated by the following table prepared by Gibbard and Harrison from the records in the British War Office which shows the great diminution of relapses under mercury and arsphenamine as compared to the use of mercury alone. There is also a great reduction in the number of "sick" days.

Treatment.	Total cases.	Average number of days in hospital on first admission.	Clinical relapses.					Average time lost by each man in days.		
			Once only.	Twice only.	Three or more times.	Total number which relapsed.	Percentage of clinical relapses.	In hospital.	Attending as an out-patient.	Total.
Mercury alone	371	42.0	151	115	49	315	83.0	66.2	17.6	83.8
Mercury and arsphenamine	152	23.2	6	0	0	6	3.9	25.2	15.8	41.0

Of all the preparations of mercury used by the mouth in the treatment of syphilis, the protoiodide is the most popular, and deservedly so, but it cannot be used in large enough dose to be really efficient. (See article on Syphilis.)

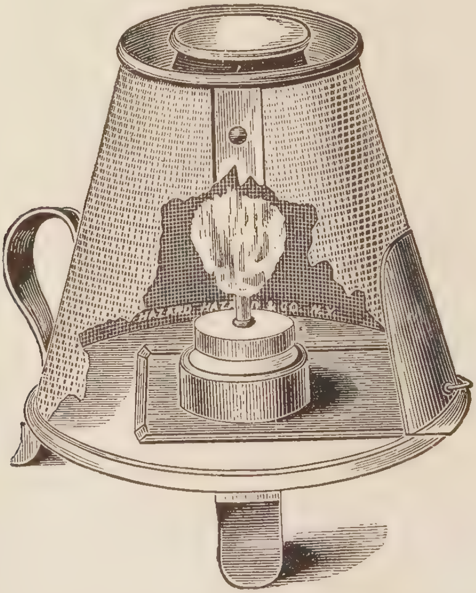

FIG. 55.—Lamp for mercurial fumigations. This lamp is made of wire gauze, and resembles the safety lamp of miners, thereby guarding against sudden explosions of the alcoholic vapors.

Mercury is often administered by means of fumigations or inhalations both for the removal of local and general syphilitic disorders. The best apparatus for either purpose is one devised by Bumstead, and it is both simple and inexpensive. It consists of a sheet-iron cup so bent that the bottom of the vessel, instead of being flat, projects upward into the center of the cup, thereby forming a raised center with a little ditch about it. The top of this projection is flattened, and on its apex is placed the calomel which is to be sublimed. The surrounding ditch is then filled with hot water, and the cup placed over an alcohol flame, which disengages the vapor of the calomel and water. (See Fig. 55.)

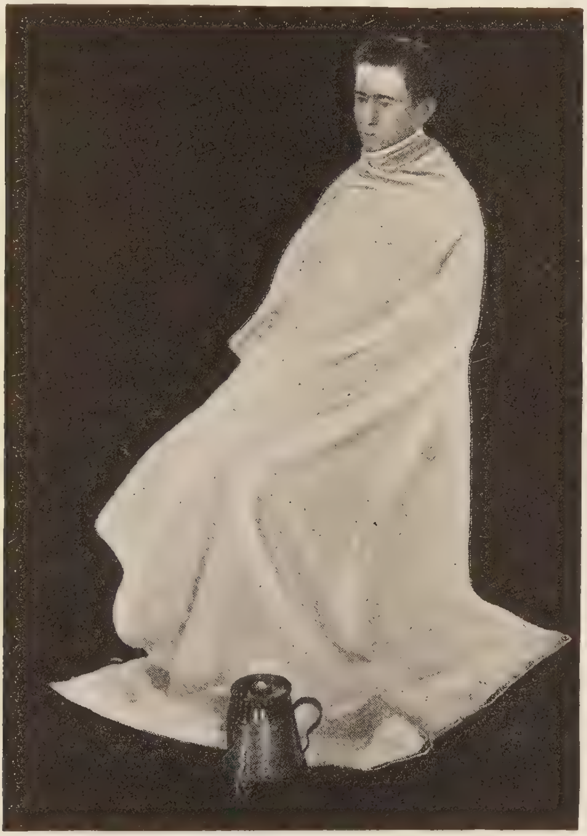

Fig. 56.—A patient prepared for the use of mercurial sublimations. A blanket having been pinned tightly around the neck after the patient is stripped, the fumigator shown at his feet is placed under his chair and the calomel placed on the central disk, as shown in the illustration. Water is in the little ditch around it and an alcohol lamp under it. The patient should be given a full, warm bath beforehand to cleanse and prepare the skin for absorption, a cotton blanket should not be used.

If general fumigations are to be practised, the patient places the lamp and cup with 30 grains (2.0) of calomel on it under a chair, on which he sits wrapped in a heavy blanket, and subjects himself not only to these fumes, but to a home-made Russian bath, which relaxes his skin and aids absorption. (See Fig. 56.)

When inhalations are used the face should be held some 6 or 8 inches from the cup to permit the fumes to pass through the air. Under these circumstances the quantity of calomel used should not exceed 4 to 5 grains (0.25–0.3), and the mouth should be rinsed out to prevent mercurial stomatitis unless a local action on the buccal mucous membrane is desired. Not more than 8 or 10 inspirations should be taken at one sitting.

The intramuscular use of mercury, if proper antisepsis and care is practised, has great advantages. When the symptoms of syphilis are urgent this method is to be resorted to and it can be employed when arsphenamine is contraindicated. (See Arsphenamine.) At such times the soluble salts, as the red iodide, are to be employed. (See Mercury Biniodide.) When they are not urgent, and the patient is not under constant observation or cannot be treated regularly, the insoluble salts are used. These salts are, however, so slowly absorbed that they may prove too inactive or finally manifest a cumulative effect.

Of the mercurial preparations which may be administered intramuscularly in syphilis, the three which surpass all others are undoubtedly the biniodide, the salicylate, the bichloride of mercury and gray oil (*Oleum Cinereum*), which, latter, was first introduced into medicine by Lang, of Vienna. (See Mercury Biniodide, Mercury Salicylate, Bichloride of Mercury and Gray Oil, under Mercury.)

In all cases the injection should be given slowly and deeply into some portion of the body in which the tissues are loose, as above the buttock or the broad of the back, and the skin of the part where the injection is to be made should be carefully washed and sterilized by the use of green soap and alcohol or tincture of iodine. (For illustration see Salicylate of Mercury.)

The intravenous injection of bichloride of mercury has been proved so dangerous as to be properly considered unjustifiable.

It is to be recalled that the herpes seen in advanced syphilitics is usually made worse by mercury. Also, that *headache* due to syphilis, if due to a cerebral growth, is benefited by mercury; while that due to anemia and debility complicating syphilis is increased by this drug.

When mercury is being freely used the teeth should be put in good order and a mouth-wash of chlorate of potassium used after each meal as well as a toothbrush. (For recipe see Potassium Chlorate.)

AS A PURGE.—The employment of mercury as a purge or laxative having a *special action on the liver* is constantly resorted to. The two preparations used are blue mass and calomel, but the latter is more active. They both cause soft or watery bilious stools, according to the dose in which they are given.

Much discussion has arisen as to whether mercury affects the liver, and whether the peculiar greenish or brownish-yellow stools produced by it are due to the presence of bile or mercury.

If there is one point firmly fixed in the mind of the average practitioner of medicine, it is that the mild chloride of mercury increases the quantity of bile in the intestine. If such a believer is questioned as to whether this increased amount of biliary fluid is due to a true increase in secretion or simply to an increase in the flow of bile from the gall-bladder, he will either state that he is unable to answer the question or that he believes that it is an increased secretion.

Practically, the position of the profession in general in regard to the purgative influence of calomel is that the drug exercises a stimulating effect upon the biliary gland. Experimentation upon the lower animals by several competent observers, and studies made by physiological chemists, fail, however, to give much light upon this subject. It is held by some that calomel never acts as calomel, but is converted by the hydrochloric acid of the gastric juice into corrosive sublimate, and that this drug then stimulates the liver to increased activity. On the other hand, the best chemical investigations show positively that the feeble acidity of the gastric juice and the temperature to which the calomel is exposed are not favorable to the conversion of a sufficient quantity of calomel into corrosive sublimate to account for any hepatic influence. Thus it was found by Rutherford and Vignal, in their well-known series of studies of the influence of drugs upon the secretion of bile, that if 5 grains (0.3) of calomel are subjected, at 100° F., for seventeen hours to the action of normal gastric juice, not more than $\frac{1}{35}$ of a grain of mercuric chloride is produced. As calomel does not remain in the human stomach for more than a day at the utmost, and generally but a few hours, it is not likely that as much as $\frac{1}{35}$ of a grain of mercuric chloride is produced from the moderately large dose of 5 grains (0.3). In contradiction of this, Bucheim, Winkler, and others assert that no conversion whatever takes place at the temperature of the body, and Jaennel's later studies support this view.

The other theory as to the change which takes place in calomel prior to its action upon the liver is that it escapes into the intestines, where it is decomposed and the gray oxide of mercury precipitated, which may, however, be held in solution by any fatty materials, which, being mixed with alkaline liquids, practically form soaps. It is thought by Wood and others that this is the more probable result, particularly in view of the fact that calomel acts more like blue mass than corrosive sublimate. Further than this, these opinions are confirmed by the fact, with which all of us are familiar, that the hepatic influence of calomel is much more positively asserted if at the same time small doses of the bicarbonate of sodium are administered. Under these circumstances the bicarbonate of sodium naturally diminishes, to some extent at least, the acidity of the gastric contents, and also directly or indirectly tends to increase the alkalinity of the contents of the duodenum.

As if to increase the complexity of the problem, the studies of Rutherford and Vignal seem to prove conclusively that, in the dog at least, mercuric chloride has a direct stimulant effect upon the hepatic cells; whereas calomel, while producing purgation by increasing the secretion of the intestinal glands, in no way increases the secretion of the bile; and this would seem to indicate that, after all, the influence of calomel upon the liver is due to a very minute portion of it being changed into corrosive sublimate. Probably the truth of the matter is, that we have as yet no definite scientific explanation of how calomel really does act. It may be that the solution of the problem lies in the hepatic influence exercised by the presence of minute quantities of corrosive sublimate, and the purgative effect produced by that portion of the calomel which has not been converted into the strong chloride of mercury. This is rendered the more likely in view of the fact that the corrosive sublimate has been found a feeble intestinal stimulant, while the calomel has been found to produce active purgation in dogs, without producing an increase in biliary flow, when the drug has been introduced into the duodenum.

It has been suggested, too, that calomel itself may stimulate the bile-expelling mechanism, while the minute portion of corrosive sublimate increases the secretion of the liquid; and, again, that by means of the purgative effect that it produces certain substances which have been in the intestine are immediately removed, and, as a consequence, a depressant influence upon the hepatic cells no longer exists.

Quite a number of physicians have studied the effect of the various so-called cholagogue drugs upon the flow of bile in human beings who have had biliary fistula. Perhaps the best studies are those of Pfaff and Balch, and more recently those of Joslin, upon women with biliary fistula. Calomel and the bichloride of mercury seemed invariably in these cases to decrease rather than increase the biliary flow. Ox-gall was the only drug which did increase it.

This subject also is of interest to the practical physician in relation to the administration of calomel in compressed tablets or other preparations when mixed with what might be called excipients. Under these circumstances, if one of the excipients is bicarbonate of sodium the tablet after a time almost always undergoes a change and becomes of a gray color. Those who have used pills or tablets of calomel which have been kept for a long period of time seem to be universally in accord with the statement that they have lost the hepatic effect which a recently prepared powder always possesses. Thus it has been frequently found that no biliary flow occurs under the use of stale tablets, whereas free bilious purging follows the administration of freshly prepared powders.

Calomel and blue mass are largely used in the condition known as *biliousness,* and undoubtedly give relief. (See Biliousness.) If the tongue is heavily coated, the breath foul, the conjunctiva a little icteroid, and headache is present, one of them should be employed. In *remittent malarial* fever the use of small repeated doses of calomel will often bring relief from the vomiting, and it should always be given in the treatment of malarial disease before quinine is used if a thorough action of the antiperiodic is to be attained, as it aids in the absorption of the drug.

One of the best ways to employ all of the various forms of mercury is in the form of triturates, which may be prepared by triturating 10 parts of the drug with 90 parts of milk-sugar. The minute subdivision of the medicament aids in its efficiency, because of its more ready absorption.

As a Disinfectant.—The disinfectant and germicidal power of bichloride of mercury and of the biniodide is well established by clinical experience and experimental investigation. The strength of the bichloride solution for antiseptic purposes may vary from 1 to 2000 to 1 to 20,000 of water, and for disinfectant use from 1 to 500 to 1 to 1000. (See Antiseptics.)

In using the bichloride of mercury as an antiseptic it is necessary to add a few grains of tartaric acid to the solution to prevent its uniting with the albumin of the tissues to form an insoluble and useless albuminate. The same is true of the use of mercury biniodide.

As an Antiphlogistic.—Formerly it was the belief of a large number of physicians that mercury possessed distinct antiphlogistic power in the early stages of acute sthenic inflammations, particularly if they involved serous membranes. It was the custom to administer full doses of calomel guarded with opium when traumatic meningitis was feared, and in endocarditis, pericarditis, pleuritis, and peritonitis its use was largely resorted to. More recently this plan of treatment has become almost obsolete, not because any deleterious effects have followed its use, but apparently as a matter of fashion. The writer believes that this is a mistake and that in acute inflammations in sthenic individuals in the early stages of disease mercury may do good.

Leaving the general subject of mercury, we may now consider each individual preparation.

Ammoniated Mercury.

White precipitate, or ammoniated mercury of the strength of 10 per cent with lard (*Hydrargyrum Ammoniatum*, U. S. and B. P.), is used in an ointment (*Unguentum Hydrargyri Ammoniati*, U. S. and B. P.) in various skin affections, when a stimulating application is needed, as, for example, in *psoriasis* and *chronic dry eczema*. It is also sometimes employed as a parasiticide in cases of *tinea*. The official ointment should generally be diluted with lard, as it is far too strong and will often induce a dermatitis if used undiluted.

In *ozena*, whether syphilitic or not, Trousseau has recommended the employment of the following powder as a snuff:

℞—Hydrargyri ammoniati	gr. iv (0.25)
Pulveris sacchari albi	℥ss (16.0).—M.

S.—To be used as a snuff, after thoroughly blowing the nose.

The red precipitate may be used instead of the white. The treatment removes the stench and may cure the complaint. It may, however, irritate the mucous membrane, in which case it should be used in the strength of 2 grains to ½ ounce (0.12–16.0). Ammoniated mercury is never used internally.

Bichloride of Mercury.

Corrosive mercuric chloride, or corrosive sublimate (*Hydrargyri Chloridum Corrosivum*, U. S.; *Hydrargyri Perchloridum*, B. P.), is an exceedingly poisonous and irritating substance when taken internally in concentrated form.

Taken internally in poisonous dose, it causes violent pain in the stomach, vomiting, purging of mucus, blood, and the contents of the intestine, collapse, and suppression of urine. Perhaps the best antidote is a pint of recently made lime water followed by lavage. If sodium thiosulphate (which see) is at hand 30 grains (2.0) or more should be given as a chemical antidote, but its value has been denied. If neither of these agents are at hand the patient should be made to swallow large quantities of white of egg, the stomach should be repeatedly washed out with warm milk by the stomach-pump, heat should be applied about the body, and the proper stimulants be given hypodermically if the pulse or respiration fail. If death does not occur within a few hours the gastro-intestinal symptoms often moderate, but the suppression of urinary secretion persists, due to the change produced in the kidneys by the drug. This change consists chiefly in injury to the secreting epithelium of the tubules, the Malpighian tufts largely escaping damage. This should be prevented, if possible, not only by the free ingestion of water by the mouth, but also by the rectal drop (see Peritonitis, Part IV), containing acetate of potassium or citrate of potassium, 1 dram to the pint. To support nutrition a 5 per cent dextrose solution may be given by the drip. This drip should be persisted in day and night unless anasarca develops, when it should be stopped. As a considerable amount of the drug is eliminated by the bowel a full colonic lavage should be done twice a day to aid in getting rid of the poison. Death may be delayed in these cases for many days. If the patient is able to retain anything in the stomach carbohydrate foods aided in their digestion by taka-diastase or pancreatin should be given in preference to proteins and fats. Stripping the capsule of the kidneys, under ether, may be tried. Recovery rarely occurs unless the stomach is rid of the poison before it can be absorbed in any quantity.

Not only does the bichloride of mercury produce symptoms of acute poisoning when taken in large doses, but it is also capable of causing a form of subacute poisoning in those patients who have it applied too freely as an antiseptic wash or lotion. Particularly are these symptoms developed after intra-uterine or vaginal irrigations with bichloride solutions. The symptoms are abdominal pain, diarrhea with tenesmus, and finally sanguinolent discharges. There is also scanty urination or the activity of the kidneys may be entirely suppressed. In some cases death comes rapidly, but sometimes even the symptoms themselves do not develop for several hours after the drug is employed.

The bichloride of mercury is often employed by hypodermic injection in *fulminant syphilis,* and is better than calomel for this purpose. About $\frac{1}{6}$ grain (0.01) may be injected deeply and gently into the cellular tissues every two or three days. When the injections are made the greatest possible cleanliness should be obtained. The syringe barrel should be of glass, the needle and syringe should be aseptic and the hands of the operator well disinfected. The best place for the injection is in the gluteal region or between the shoulder-blades. (See Salicylate of Mercury.)

The intraspinal injection of mercurialized serum has been practised with sufficiently good results in cerebrospinal syphilis to justify its being mentioned. It would seem that these injections are prone to produce more irritation than intraspinal injections of salvarsanized serum, and, like such injections, may induce a crisis in ataxia. The advantages of the method are that a preliminary intravenous injection is not required, and a large amount of serum may be made up at one time and kept under strict antisepsis for several weeks. The first dose should be small. In ataxia it would appear that the dose should be at longer intervals than in other types of cerebrospinal syphilis. In the latter the treatments may be as frequent as once or twice a week for three weeks. Mercurialized serum is not as efficacious as salvarsanized serum, but may prove a useful substitute, although doubt as to the efficiency of intraspinal injections in cerebrospinal syphilis seems to be increasing. The following method by Haller of preparing mercurialized serum is given.

In the preparation of mercurialized serum, blood is withdrawn from a vein and allowed to clot. The expressed serum is centrifuged in order to free it from cells. The serum is then pipetted into glass tubes in 8 cc. amounts, and to each tube is added 0.001 gram of mercuric chloride in a 0.1 per cent aqueous solution. The fluid is agitated for a few moments in order to insure a thorough mixing. The white ring of precipitated albuminate of mercury quickly redissolves in the excess of serum, giving a perfectly clear solution. The tubes are plugged and the serum inactivated for thirty minutes at 56° C. They are then stored away on ice until needed, when they are warmed to body temperature and the serum is administered.

The amount of serum used has seemed to be of relatively little importance, although excessive amounts probably add to the immediate reaction. From 6 to 8 cc. has been the amount used in most of the doses given in *spinal syphilis,* for the reason that about that amount of spinal fluid is usually withdrawn for cell count, globulin and Wassermann tests. The dose of mercuric chloride has been varied from 0.0005 to 0.002 gram. The degree of immediate reaction is not perceptibly changed by increasing the amount to 0.001 gram, but an increase above this figure has seemed to add materially to the discomfort of the patient. The length of time during which the serum was heated to 56° C. has been varied from twenty minutes to two hours without apparently affecting the degree of reaction. The age of serum does not perceptibly add to its irritating properties. Several doses kept on ice for eight weeks and more were followed by less disturbance than many which were administered within twenty-four hours after preparation.

In *tonsillitis,* where the inflammation is severe, it is often used early with great service. (See also Mercury Biniodide.)

In small amounts—that is, in $\frac{1}{60}$ to $\frac{1}{40}$ grain (0.001–0.0015) three times a day—the bichloride is one of the best remedies for the treatment of *anemia* depending upon a deficient number of blood cells. If the anemia is syphilitic in origin, it is, of course, peculiarly useful. Bichloride of mercury is of value in minute doses of $\frac{1}{500}$ grain (0.0001) for the ill-smelling green stools of *summer diarrheas* in adults and children, and it has been recommended that a solution be made of $\frac{1}{2}$ grain (0.03) in 5 ounces (150.0) of water, and a teaspoonful given every hour until relief is obtained. The water used in making the solution should be distilled, and it may be well to add to it a little tartaric acid to prevent precipitation of the bichloride by organic matter which may have gotten into the water. This treatment is particularly useful in *mucous diarrhea* in which blood and mucus are thoroughly mixed. Patients in the dispensaries often speak of these passages as containing "corruption," and others think they consist of "lumps of flesh," owing to the masses of blood and mucus. Whether the disease be acute or chronic, the bichloride, used in the way just described, will be found of service. In *dysentery* and the *diarrhea* of adults the same treatment may be resorted to, using 2 teaspoonfuls of the solution instead of 1. It is hardly necessary to add that the greatest care must be bestowed upon the diet and clothing. The author has treated a child suffering from persistent diarrhea for months with varying success, only to succeed when, it being found that the abdomen was exposed to the air, the mother was forced to apply and keep on the child a flannel binder.

In some cases in which an *obstinate syphiloderm* is present $\frac{1}{2}$ ounce (16.0) of corrosive sublimate and 1 ounce (30.0) of chloride of ammonium may be added to a warm bath, which should be taken every few days. One-half a grain (0.3) of the bichloride of mercury in 6 ounces (180.0) of water is said to be efficient as an injection in *gleet,* if used every three or four hours. (See Gonorrhea.)

In all *parasitic affections of the skin* a solution of 2 grains (0.12) of bichloride to 1 ounce (30.0) of water may be sopped on the part three times a day. A solution of perchloride of mercury (*Liquor*

Hydrargyri Perchloridi) 1 to 1000 is official in the B. P. It is given in the dose of ½ to 1 fluidram (2.0–4.0).

Tablets for surgical use are now official under the name of *Toxitabellæ Hydrargyri Chloridi Corrosivi*, U. S.

(For the disinfectant uses of the bichloride of mercury see Disinfectants.)

Biniodide of Mercury.

Red mercuric iodide (*Hydrargyri Iodidum Rubrum*, U. S. and B. P.) is a bright red powder, possessing irritant powers equal to or greater than those of the bichloride, and causing symptoms, when taken in overdose, closely resembling those produced by the latter drug. Owing to the formation of the salt, it is thought to be particularly useful in the later stages of *syphilis*. The dose is $\frac{1}{30}$ to $\frac{1}{15}$ grain (0.002–0.004). It may also be given intramuscularly dissolved in water or oil. The best way to employ it is to buy it in ampoules containing ⅙ grain (0.01) with ⅙ grain (0.01) sodium iodide in 1 cc. of normal salt solution to aid in its solution. I usually give a course of 12 injections, one every other day and then wait a month before repeating them. If oil is used absorption is slower than if water solutions are employed. (See Syphilis.) An ointment (*Unguentum Hydrargyri Iodidi Rubri*, B. P.) is useful as an application in *goiter* and *obstinate skin diseases*. In the dose of $\frac{1}{200}$ grain every hour for 4 or 6 doses this drug is a most useful remedy to abort *acute tonsillitis*.

At one time it was thought that biniodide of mercury was a better antiseptic than the bichloride, but recent researches have proved that this is not a fact. An efficient germicidal soap containing 1 and 2 per cent of mercuric iodide is on the market.

Black Wash.

Black wash (*Lotio Hydrargyri Nigra*, B. P.) is made by adding 1 dram of calomel to 1 pint (4.0:480 cc.) of lime-water. It is used as a stimulant application for washing *syphilitic sores* and *wounds* in various forms of *eczema*.

Blue Mass.

Blue mass (*Massa Hydrargyri*, U. S.; *Pilula Hydrargyri*, B. P.) is made by rubbing up metallic mercury with liquorice and other excipients, and is often called blue pill. Each grain of the mass contains ⅓ grain (0.02) of mercury, and it may be given in the dose of from ½ to 20 grains (0.03–1.3) for the same laxative purposes for which calomel is used. Blue mass is rarely employed to produce systemic effects.

Calomel.

Calomel (*Hydrargyri Chloridum Mite*, U. S.; *Hydrargyri Subchloridum*, B. P.), or mild mercurous chloride, is an insoluble salt which is, nevertheless, freely absorbed.

Calomel when used as a laxative purge should be given in the dose of $\frac{1}{6}$ to $\frac{1}{2}$ grain (0.01–0.03) every half-hour or every fifteen minutes until 1 or 2 grains (0.06–0.12) are taken, as it will often act as efficiently in this way as if 10 grains (0.6) are given at one dose, and there is no danger of producing ptyalism. The reason that small doses are as efficient as large ones lies in the fact that only the calomel which is changed into the gray oxide is active, and, as the amount of alkaline juice in the intestine is small, only a minor part of a large dose of calomel acts, the major portion escaping unchanged. This is the reason that bicarbonate of sodium is added to calomel powders, to aid the intestinal juice in the reduction of the salt. While this statement as to small dose is true of the use of calomel in temperate climates, it does not hold good in hot climates, where much larger doses, amounting to 10 (0.6) or even 20 grains (1.3 are often given to affect the flow of bile, the hepatic gland being made torpid by heat. If purgation does not occur after a full dose of calomel, a saline purge must be given at the end of the twenty-four hours, and this must always be used if large doses of the mercurial are employed, to avoid possible mercurialization.

Mercury in the form of calomel has been used hypodermically in the treatment of *syphilis*. It is best used in the dose of 1 to 3 grains (0.05–0.15) suspended in goose oil put up in sterile ampoules. It should be injected deeply into the tissues, not immediately underneath the skin, the greatest cleanliness being necessary to avoid abscesses. The best place for these injections is above the fold of the buttocks, but sloughing, tetanus, and even gangrene have followed its employment in this way. (See also Salicylate of Mercury, Biniodide of Mercury, and Gray Oil.)

Calomel has been used by inunction in *syphilis*, put up in the form of "calomelettes" containing in each 100 grains (6.6) of cocoa butter, 50 grains (3.3) of calomel. These have the advantage over Blue Ointment of not staining the skin or clothing, but calomel ointment is not equally effective.

In *dysentery* of the acute form calomel and ipecac are valuable remedies. (See Dysentery and Ipecac.) The calomel should be given in small doses, repeated every hour or half-hour until a favorable change in the number and character of the stools appears. Calomel is not to be used if great asthenia complicates the disease.

In children who seem constantly "under the weather" and never quite well, who have *flatulence, fetid breath*, and *ill-smelling, pasty stools*, calomel often gives great relief in the dose of grain $\frac{1}{20}$ (0.003) every half-hour until four doses are taken, this treatment being pursued every fourth or fifth morning.

In slight *jaundice* due to cold and hepatic congestion $\frac{1}{6}$ grain (0.01) of calomel every half-hour until 1 grain (0.06) is taken will often bring relief. It is contraindicated in obstructive jaundice.

Calomel is generally prescribed in conjunction with sugar of milk, white sugar, or bicarbonate of sodium, which are added to increase the bulk and wieldiness of the powder, and, in the case of the first ingredient, to increase its activity by finely grinding it. Owing to its lack of taste, calomel is often placed on the tongue in children, and for this class of patients white sugar is to be used in small quantity as a vehicle, as the other vehicles are less agreeable. The most pleasant form of administration is by means of triturates. These should not be compressed.

It is important to remember that calomel when used as an antisyphilitic produces salivation much earlier than the other mercurials.

Sometimes calomel is of value when dusted into the eye in cases of *phlyctenular conjunctivitis* which are strumous. This practice must not be resorted to if iodine or iodides are being taken internally, as the iodine is eliminated by the tears and forms a compound which burns the conjunctiva.

A very important use of calomel and one which has been brought forward as new, but which is really many years old, is its employment in *dropsy* as a diuretic, either alone or combined with squills or digitalis, or with opium to prevent purging. The dose is small, about 1 grain (0.06) thrice a day, and if a diuretic influence does not assert itself in forty-eight hours it should not be continued. How calomel acts to produce the increased urinary flow under these circumstances is not known. Some suppose that it aids the absorption of liquid from dropsical tissues, and so increases urinary secretion; others think that it stimulates the renal epithelium to greater activity. The latter view seems the least probable of the two, but neither theory has been proved correct, although experimentation supports the view first named. The full urinary effect of the drug is not felt till the second or third day of its use, and speedily passes away, particularly as purging is often induced very early. Still another use of calomel is in *typhoid fever,* in which disease it has been highly recommended in small repeated doses, particularly if constipation is present. In the opinion of the author this is disadvantageous as a routine measure and entirely uncalled for, although in the very early stages of the disease, when the bowels are confined and the tongue coated, a dose of 1 grain (0.06) in fourths with a little bicarbonate of sodium is useful followed by a Seidlitz Powder.

Sydney Ringer called attention to the fact that in constipation or in "*biliousness*" podophyllin does more good than calomel, provided that the stools are dark in color, whereas if the same symptoms are present, but the stools light and clayey in color, calomel is more efficient. The author has proved the correctness of this assertion so frequently that he is convinced of its truth.

Calomel has been recommended in the condition of *anorexia* and depression following acute diseases, and when the tongue is covered by a thick yellow coat it is the remedy for the gastro-intestinal torpor always present. While purgative doses of calomel certainly are of value, the use of freshly prepared nitro-muriatic acid is, however, highly preferable to the mercurial salt in many such instances. Both of these drugs should not be given simultaneously, because they are incompatible.

Calomel is often given in small doses to "settle the stomach." Sometimes it will act in this way, but in other cases it will seem to increase the nausea and bring on vomiting. This is true of both adults and children, and it is impossible to tell beforehand which will occur. Ringer asserts that in a peculiar form of vomiting occurring in very young children, which comes on immediately after the food is swallowed the rejection of milk being forcible, and perhaps so sudden that it is not even curdled, and which is not accompanied by much straining, calomel will often give relief when all other remedies fail. It should not be resorted to until some evidences of wasting occur, as this action of the stomach in many children only rids that organ of that part of the milk which is in excess, and is a purely physiological regurgitation. The calomel may be given in the dose of $\frac{1}{12}$ grain (0.005) every hour, or, if preferred, gray powder in the dose of $\frac{1}{3}$ grain (0.02) every hour for three doses, is equally efficient in these cases. If it fails to give relief and vomiting is projectile, hypertrophic stenosis of the pylorus is perhaps the cause. (See Atropine.)

Calomel in a fine powder will often remove *syphilitic condylomata* if dusted over them for some time, and an ointment made of 1 dram (4.0) of calomel to 1 ounce (30.0) of lard is very useful in *pruritus ani.*

It has been proved that an ointment of calomel if used on the penis immediately after sexual intercourse acts as an efficient *prophylactic against syphilis.* The strength used is 4 drams (15.0) to the ounce (30.0).

The B. P. contains a pill mass of calomel, called *Pilula Hydrargyri Subchloridi Composita,* which contains antimony, guaiac resin, and castor oil. Its dose is 2 to 8 grains (0.12–0.5).

Calomel ointment (*Unguentum Hydrargyri Subchloridi,* B. P.) is often useful in the treatment of small patches of *eczema,* or the following prescription may be given:

℞—Hydrargyri chloridi mitis	gr. xl (2.6)
Magnesii carbonatis	gr. xl (2.6)
Unguenti aquæ rosæ	℥j (30.0).—M.

Paderi asserts, in the *Journal of the Chemical Society* for 1920, that if calomel is combined with antipyrine it produces a substance more toxic than corrosive sublimate.

Gray Oil.

Gray oil (*Oleum Cinereum*) is prepared as follows: 2 drams (8.0) of lanolin are rubbed up with sufficient chloroform to emulsify it.

The rubbing process is continued until most of the chloroform is evaporated, and while the mixture is still in a fluid state metallic mercury, in double the amount of lanolin, 4 drams (16.0), is added and the trituration continued. By this means an ointment of mercury is left which equals 2 parts of mercury and 1 of lanolin. This is sometimes called strong gray ointment. For hypodermic injection 3 parts of this gray ointment are added to 1 part of olive oil, or it may be still further diluted by adding olive oil in the proportion of half-and-half. Of this mixture 1 to 2 minims (0.05–0.1) may be injected every second or third day.

By some practitioners this preparation is considered much better than any other for hypodermic use in *syphilis*.

Mercury with Chalk.

Mercury with chalk (*Hydrargyrum cum Creta*, U. S. and B. P.), or gray powder, is slightly purgative, but is chiefly employed in the treatment of *infantile syphilis*, as it will not freely purge. It is composed of 38 parts of mercury, 10 parts of honey, and 57 parts of prepared chalk. The dose is 1 to 10 grains (0.06–0.6). Children suffering from *syphilitic marasmus* seem fairly to fatten on it. This preparation is also of service in the syphilis of adults, and may be employed whenever the laxative effect of mercury is not desired.

In the treatment of *infantile diarrhea* with watery, colorless stools containing undigested food gray powder in small doses is often very useful.

Mercury Ointment.

The ointment of mercury, (*Unguentum Hydrargyri Fortius*, U. S. and B. P.), is of 50 per cent strength. Blue ointment is made by rubbing up metallic mercury and an ointment base until the mercury is extinguished, or, in other words, until the globules of mercury cannot be seen with a magnifying power of 10 diameters. *Unguentum Hydrargyri Mite*, U. S., 33 per cent, containing 67 parts of mercurial ointment in 100 in parts of petrolatum is also official. The first of these is the preferable preparation for systemic medication whereas the weaker ointment is employed for treating skin diseases.

An efficient method of using mercury by inunction is to employ so-called "Mercurettes" which consist of minutely subdivided metallic mercury in cocoa butter compressed into small blocks, each containing 50 grains (3.3) of mercury. (See Calomelettes under Calomel.)

The ointment of mercury is used externally in skin affections and for the purpose of influencing the general system. In *syphilis* the ointment in small amounts should be thoroughly rubbed into the skin in various parts of the body—one evening in the left groin, the next evening in the right groin, the following evening below the left axilla, and the fourth evening below the right axilla, beginning on the fifth evening in the left groin once more. This avoids local irritation of the skin by too frequent applications, places the drug on spots where it is readily absorbed, and rapidly influences the system of the patient. Wild and Roberts have shown that when as much as 1 dram of the official ointment is given by inunction as much as 2½ grains of mercury are found to enter the system at the end of ten minutes. In *infantile syphilis* this method may be employed, or a flannel binder covered with the ointment may be placed about the belly. The clothes should not be changed too frequently, as their saturation aids in producing the effects. The wearing of an undershirt saturated with the ointment is a valuable, though somewhat dirty, method of producing mercurialization.

When the use of mercurial ointment in the usual areas is inadvisable, because its presence is shown to others, it may be applied to the sole of each foot on alternate days, the patient wearing dark stockings.

Under the name of Oleate of Mercury (*Oleatum Hydrargyri,* U. S. and B. P.) a very efficient and more agreeable application than the ointment is used in its place or still further diluted with lard, when it becomes the *Unguentum Hydrargyri Oleatis,* B. P. It is made from the yellow oxide of mercury. (See Oxides of Mercury.)

For *pediculus pubis,* or in any case where parasites, such as the flea or louse, infest the region of the genitals or any spot covered by a hairy growth, mercurial ointment may be used as a remedy, owing to its lethal influence over these pests. Care should be taken that it does not cause salivation of the patient, and it must not be allowed to remain on the parts, but be wiped off in the course of an hour or two or less. "We may here say that if it is once understood that all insects, including lice, are destroyed quickly by the application of any fixed or volatile oil, physicians will see there is no necessity of employing remedies of a noxious character to the patient. The fat of mercurial ointment is probably more active than the mercury itself." (Leidy.)

Linimentum Hydrargyri, B. P., and *Emplastrum Hydrargyri,* B. P. are used for the same purposes as is the ointment of mercury. The plaster is made with olive oil, resin, and lead plaster instead of ordinary suet or lard.

Nitrate of Mercury.

The solution of mercuric nitrate (*Liquor Hydrargyri Nitratis Acidus,* B. P.), acid nitrate of mercury, is an exceedingly active penetrating caustic, so rapid in its effects that it seems to eat into the tissues. It may be employed for the removal of *epitheliomata,* and *large warts,* and should be applied by means of a glass rod. This treatment may also be resorted to with advantage in *lupus* until the surface of the growth is level with the skin. The surrounding parts should be protected by lard or oil. As this treatment is very painful, the spot may be first procainized and afterward covered with flexible collodion.

Citrine ointment (*Unguentum Hydrargyri Nitratis*, B. P.) is used as a stimulating application in cases of *chronic skin diseases* of the scalp and trunk. It is too strong for ordinary use, and should be diluted one-half or less with lard according to the stimulating effect required; the dilute ointment is official in the B. P. as *Unguentum Hydrargyri Nitratis Dilutum.*

Oxides of Mercury.

The yellow and the red mercury oxides (*Hydrargyri Oxidum Flavum*, U. S. and B. P., and *Hydrargyri Oxidum Rubrum*, B. P.), red precipitate, are used largely as a dressing for *syphilitic sores* when diluted about one-half with chalk or other powder. If used pure, they are somewhat caustic. From the yellow oxide is made the oleate of mercury (*Oleatum Hydrargyri*, U. S., *Hydrargyrum Oleatum*, B. P.) which is used for the same purpose as ordinary mercurial ointment.

In *intestinal* and *gastric indigestion*, with foul belching and very ill-smelling stools which are due to intestinal fermentation, the yellow oxide is sometimes given in the dose of $\frac{1}{60}$ to $\frac{1}{50}$ grain (0.001–0.0012) in a triturate.

Red precipitate ointment (*Unguentum Hydrargyri Oxidi Rubri*, B. P.) and the ointment of the yellow oxide (*Unguentum Hydrargyri Oxidi Flavi*, U. S. and B. P.) are largely used, the first named diluted one-half with lard, for *chronic scaly skin affections.* The ointment of yellow oxide is used for *obstinate conjunctivitis*, and in *granular lids* and *styes.* It has been reduced from its former 10 per cent strength to 1 per cent. (See Styes.) These ointments should be freshly prepared.

Protiodide of Mercury.

Yellow mercurous iodide (*Hydrargyri Iodidum Flavum*, U. S.) is much more mild than the biniodide, and is given for exactly the same purposes. It is often useful in *chronic Bright's disease.* It is to be remembered as the best mercurial by the mouth for ordinary cases of *secondary syphilis.* (See Syphilis, Part IV.) It should be given in ascending doses. The beginning dose is $\frac{1}{6}$ to $\frac{1}{4}$ grain (0.01–0.015) three times a day.

Salicylate of Mercury.

Hydrargyri Salicylas, U. S., is a drug which has come into quite general use since the introduction of the intramuscular method of administering mercury in *syphilis.* It may be suspended in goose grease in the proportion of 1 grain (0.05) of the salicylate of mercury to 10 minims (0.6) of the fat, and before it is used the bottle must be well shaken in order that the insoluble mercury may not remain at the bottom.

Salicylate of mercury is also placed on the market in sterile ampoules, containing 1 grain (0.06) or more. As the drug is suspended in a fatty base it must be warmed in order to liquefy it. The best ampoules to use are those in which goose oil is employed, as it remains in fluid form at ordinary temperature and so does not need heating.

Before giving the injection the buttock should be painted with tincture of iodine. The needle should be large and long and well oiled before it is used. A 20-gauge needle is the best needle to use to carry the heavy fluid. If an oily solution is used the mercurial does not attack the metal. The buttock having been sterilized, the injection should be given while the patient is in the prone position at the sites shown in Fig. 57. After the needle is in the muscle, suction is to be made to see if blood appears. If so, withdraw the needle and puncture elsewhere. After injection disconnect the syringe from the needle, draw a little air into the syringe and inject it through the needle which is left in place. By this means none of the drug is drawn into the line of puncture on withdrawing the needle. After this is done give gentle massage and use a compress for a few moments to prevent the injected liquid from following the track of the needle

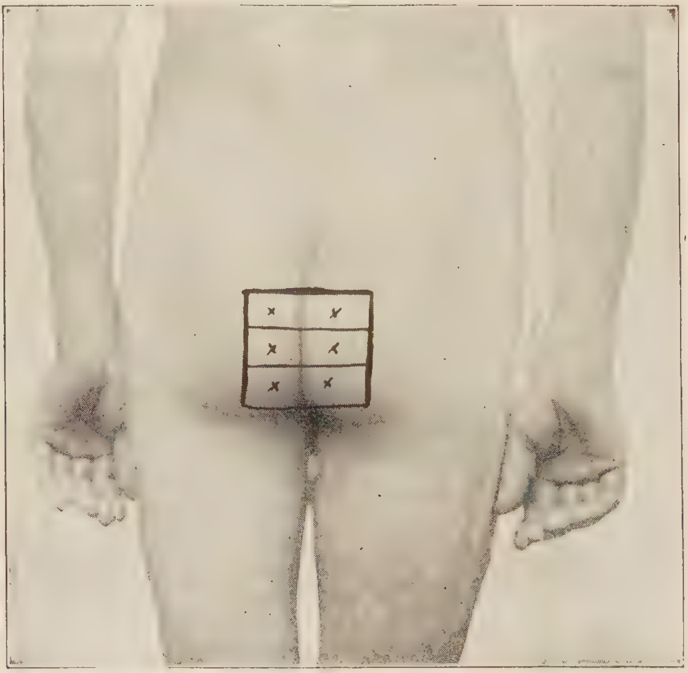

FIG. 57.—Sites for the mercurial injections. (Gottheil.)

toward the skin. This method has a great advantage in point of convenience and pain, as compared to the bichloride of mercury which often causes soreness and induration. It is of great importance that the needle and syringe should be thoroughly cleansed after each injection, as the insoluble drug readily clogs the instrument. One grain should be injected deeply into the muscles of the upper gluteal region every fourth day, and this may be increased to every second day if no evidences of the systemic action of the drug appear, but these injections should not be continued too long, as absorption is uncertain as to speed and ptyalism may be induced.

Yellow Sulphate of Mercury.

Hydrargyri Subsulphas Flavus has been used under the name of turpeth mineral as an irritant in *chronic ophthalmia* and also as a prompt emetic in *croup.* It is a quick and certain emetic, and it is claimed, does not produce depression, but the writer would recommend great care in its use. The dose for a two-year-old child is 2 to 5 grains (0.12–0.3), repeated in fifteen minutes if necessary.

If as much as 5 grains (0.3) has been given, and emesis does not follow, other emetics or the stomach-pump must be used to prevent gastro-intestinal irritation.

Yellow Wash.

Yellow wash (*Lotio Hydrargyri Flava,* B. P.) is made by adding 30 grains (2.0) of corrosive sublimate to 1 pint (480 cc.) of lime-water. It is used for the same purposes as the black wash already mentioned, but is much more stimulating.

Incompatibles.—Bichloride of mercury should never be given with any other substance except iodide of potassium and chloride of ammonium, as it is incompatible with almost every other drug. With the iodide of potassium it may be used because the precipitate formed is at once redissolved and the resulting mixture is highly alterative.

Calomel should never be given with iodides or bromides, and hydrochloric acid may convert it into the bichloride if the acid is present in any amount. It is also incompatible with antipyrine.

METAPHEN.

Metaphen is an organic mercurial which is chemically 4′ nitro′ 3, 5′ bisacetoxymercuri′ 2′ cresol. It possesses definite parasiticidal properties and in dilute form is an efficient antiseptic. When properly diluted for therapeutic purposes, it is not irritant and may be employed as an antiseptic in ordinary surgical procedures and in infections of the eye, ears, nose and throat as well as the genito-urinary tract, as for acute *cold in the head* and *throat,* and in *gonorrhea.*

In the strength of 1 to 10,000 it is an excellent irrigation fluid for large *infected wounds*, and it is much more powerful than mercury bichloride. Thus anthrax bacilli are destroyed by a 1 to 326,000 solution whereas 1 to 29,000 is needed of mercury bichloride.

It appears on the market in a 1 to 500 solution, which is commonly diluted 1 to 5 to 1 to 10 for the purposes named, and in ampoules of 10 cc. of 1 to 1000. Furthermore, it may be given intravenously in the treatment of *syphilis* with, or without, being mixed with neoarsphenamine, such a mixture not splitting off the metals.

When given intravenously in *syphilis* a dose of 10 cc. of a 1 to 1000 solution is given every second or third day for 10 to 20 injections. When given simultaneously with neoarsphenamine the latter drug may be dissolved in 10 cc. of a 1 to 1000 solution and given at weekly intervals, but it would seem best to give these drugs in alternate courses. For such uses as already stated metaphen is placed on the market in ampoules of 10 cc. each.

Its intravenous use has also been suggested in the treatment of *septicemia*, as it is claimed that it does not damage the kidneys, as do other compounds of mercury. Its solution does not stain.

METHENAMINE.

Urotropin (*Methenamine*, U. S., *Hexamine*, B. P.), also made in the United States under the name Uritone, is produced by the action of ammonia upon formaldehyde. When taken internally it sets free formaldehyde in the urine. Burman states that 10 grains three times a day will give approximately 1 to 5000 of formaldehyde in the urine. Formaldehyde appears in the urine in from one to three hours after a dose is given, but its maximum appears in from four to eight hours. It is used to render the urine acid and clear when this secretion is excessively alkaline, loaded with phosphates and amorphous urates, and purulent. It allays irritability of the bladder due to this cause, as, for example, that due to *ammoniacal cystitis*. In *pyelitis* and *cystitis* the microörganisms present in the urine should be isolated, and if it be the colon bacillus, acid sodium phosphate ($NaH_2Po_4H_2O$) in 10-grain (0.65) doses, dissolved in plenty of water, be given every two or three hours so as to make the urine acid, since more formaldehyde is liberated from the urotropin if the urine is kept acid. To use vegetable salts of potassium to make the urine alkaline and so unfavorable to the existence of the colon bacillus simultaneously with hexamethyenamine is obviously futile. Indeed, it may be said that, unless the urine in the bladder is acid, enough formaldehyde is not set free to do any good. It is chiefly in the bladder and not in the kidneys that the drug is decomposed. Urotropin is largely employed to render the urine sterile in cases of *typhoid fever* and to act as an *intestinal antiseptic*. For the former purpose it is of some value not only in avoiding secondary vesical diseases, but in preventing the spread of typhoid fever to others. Investigations indicate that when large doses are given some of it is eliminated by the liver in the bile, and also by the walls of the gall-bladder and mucous membrane of the nose. This is the reason for its use in enteric fever to prevent cholecystitis but it is probably useless. Crowe asserted that it appears within an hour in the cerebrospinal fluid, and although doubt has been thrown on this statement, in that the spinal fluid being alkaline does not set free formaldhyde, nevertheless it may be used in *traumatism of the brain and cord* with the hope of preventing infection. Doses about double the ordinary amount are used for this purpose.

In the presence of an epidemic of *poliomyelitis* it has been used as a prophylactic. Methenamine is also used to abort *acute coryza.*

In ordinary cases the dose is 10 to 30 grains (0.65–2.0), taken two or three times a day, dissolved in a ½ pint of carbonated or plain water, but in some cases larger doses are needful.

Where a full effect is required smaller doses may be given five or six times a day, and it may be given in keratin-coated pills, since every grain altered by acid in the stomach produces that much less effect in the bladder. The continued use of large doses often results in hematuria and strangury, the blood coming from the bladder rather than the kidneys.

METHYL BLUE.

Methyl blue, or methyl violet, is an aniline dye often sold under the name of pyoktanin. When used medicinally it must be perfectly pure and deprived of its usual contaminating matter, arsenic, which if present causes local irritation of the part to which it is applied. Pyoktanin was introduced to professional notice under this name by Stilling as an antiseptic, but careful study has proved it to possess but feeble power over the growth of germs. In all conditions of the eye in which antiseptic lotions are indicated pyoktanin has been stated to be of value, but elsewhere in surgery it is practically useless as an antiseptic. Even in the eye it possesses, according to de Schweinitz, a limited range of usefulness, being no better than the older antiseptics, except in diseases of the lacrimal apparatus. The fact that pyoktanin stains everything it touches is a great disadvantage in its use. It may be tried in *blepharitis, eczema of the eyelids, conjunctivitis,* both simple and phlyctenular, and in the treatment of *corneal ulcer.* When so employed, it should be applied in the strength of 1 to 1000 of water.

It should be remembered that any pure aniline dye may be used in place of pyoktanin. Thus some physicians have used yellow pyoktanin or auranine.

Methyl blue and similar aniline substances have been largely employed by some physicians in the treatment of *malignant neoplasms.* The solution (1 to 500 of water) should be filtered through hot asbestos to render it sterile, and every antiseptic precaution carefully observed in giving the injection. The dose is ½ to 3 drams (2.0–12.0) of this solution every other day or every third day, and the injection is to be given either into the growth itself if it is large, or just at its side, in the healthy tissues, if it is small. Too much should not be injected into one spot lest it cause a slough. This treatment does not cure the disease. It relieves pain and so quiets the patient, and in rare cases checks the growth of the tumor. If the growth sloughs, complete antiseptic dressing is necessary. An antiseptic pyoktanin-gauze dressing should always be used while the treatment is under way.

METHYLENE BLUE.

Methylene blue (*Methylthioninæ Chloridum,* U. S.) is to be distinctly separated in the mind of the student from methyl blue, which is practically what is known by the trade name of "pyoktanin." The latter ought not to be used internally. Methylene blue occurs as a dark green, crystalline powder, or in the form of prismatic crystals having a bronze-like luster. It is readily soluble in water and somewhat less readily in alcohol, the solutions having a deep blue color. Methylene blue can be distinguished from methyl blue by this test: With sodium hydroxide methyl blue gives a purplish-red, while methylene blue turns a deep violet. Also, when a solution of the former is made in a test-tube the meniscus is blue, whereas with methylene blue it is greenish.

Methylene blue has been employed in the treatment of *malignant growths* and in *malarial fevers* with asserted success, although its successful use in the first group of cases is decidedly problematical. When used in the treatment of *sarcoma* and *cancer,* from ½ to 2 grains (0.03 0.12) in watery solution are injected daily or on alternate days directly into the growth. The neoplasm, it is said, ceases to grow, shrinks, and comes away, leaving a fairly healthy sloughing surface. This treatment is so uncertain that it should only be tried in inoperable cases, and in this class of patients its local use often seems to relieve the pain and check the fetor.

In *malarial fever* of the intermittent type methylene blue seems to possess distinct curative powers. It is not so powerful as quinine by any means, but has its chief sphere of usefulness in patients who cannot take quinine or where quinine has been tried unsuccessfully. This antimalarial influence is due to its destruction of the *plasmodium malariæ,* but its administration must begin from seven to ten hours before the expected intermittent paroxysm and be continued after the attacks have ceased and for some little time after the physician fails to find the microörganisms in the blood, as relapses are common. Particularly good results seem to follow the use of methylene blue in children suffering from malaria. Untoward symptoms from its use are not common, but when they do occur consist in slight vertigo, nausea, and some strangury, which latter symptom can be prevented to a great extent if powdered nutmeg (equal parts) is given simultaneously. The urine is always blue from the elimination of the drug through the kidneys.

Methylene blue has been highly recommended by Horwitz in the treatment of the earlier stages of *gonorrhea,* as it shortens the course of the disease. He suggests the following formula:

Methylene blue	2 grains	(0.12)
Oil of sandalwood	3 “	(0.2)
Oleo-resin of copaiba	3 “	(0.2)
Oil of cinnamon	1 minim	(0.05)

To be made in one capsule, three of which are to be taken each day.

Injected into a muscle in the dose of 1 grain in 10 minims of water, methylene blue is used to test the activity of the *eliminative function of the kidneys.* In health it should appear in the urine in fifteen to thirty minutes, and persist for thirty-six hours.

When the kidneys are healthy the same test may be made to determine whether an effusion in the pleural cavity or peritoneum is capable of being absorbed as a result of purgation. From 1 to 3 grains in solution are injected into the fluid in the chest, or abdomen, and a purge given. If the blue does not appear in the urine, this fact shows that absorption from the pleura or peritoneum has not occurred, because the lymphatics are blocked by inflammatory exudate.

The ordinary dose in the treatment of malaria is 2 to 4 grains (0.12–0.25) every four hours to adults, or 1 to 2 grains (0.06–0.12) to children of five years, preferably given in capsule.

MUSTARD.

Mustard is official in the form of *Sinapis Nigra,* U. S., or black mustard, derived from the seeds of *Brassica nigra.* An irritant oil (*Oleum Sinapis Volatile,* U. S. and B. P.) is formed by ferment action when black mustard comes in contact with water. An albuminoid ferment, myrosin, acts in the presence of H_2O on the glucoside sinigrin, forming the oil and dextrose.

Therapeutics.—Mustard is often used in the form of mustard flour as an emetic when stirred in water in the proportion of 2 tablespoonfuls to a glass of water. It is also employed as a counterirritant and as a condiment. If given in excessive dose, it will cause violent gastritis, and chronic gastritis is often set up by its constant use in excess. Its internal use is contraindicated during the existence of acute gastritis and all states of gastro-intestinal irritation.

When used as a counterirritant mustard is applied to relieve the pain of *colic* due to *flatulence* and *acute inflammation* of the abdominal and thoracic viscera, that due to *muscular rheumatism, inflamed joints,* and *neuralgia*, and it may be applied at the nape of the neck in cases of *headache* and *cerebral congestion*. When applied to the skin of an ordinary individual, it will produce a severe burn if left on more than a few minutes, and it should be mixed with wheat flour in the proportion of 1 to 4 when used upon tender skins. Children generally will not tolerate more than one-sixth mustard. The plaster should be made by mixing mustard flour and wheat flour together and then moistening the mixed flours with warm water or warm vinegar, or a little brandy may be used.

In the *capillary bronchitis* of young children and in the early stages of the *eruptive fevers*, when there is torpor and a poorly developed rash, mustard oil may be used in conjunction with the wet-pack in the following manner: It is particularly indicated when there is paralysis of the peripheral capillaries and mottling of the skin. A piece of flannel large enough to surround the child from its neck to its feet is wet with a mixture made as follows: To 8 ounces (250 cc.) of water at room temperature add the same amount of alcohol. To this alcohol-water mixture is added 1 to 2 ounces (30.0–60.0) of a mixture composed of 1 part of oil of mustard and 49 of pure alcohol. After the flannel wet in this manner is wrapped about the child, the patient is wrapped again in a dry sheet or light blanket and allowed to rest for ten to twenty minutes. When the flannel is taken off, the skin is found ruddy with blood and the general state improved. The child is now wrapped in a dry flannel or blanket and allowed to sleep. This plan cannot be used oftener than once in twenty-four hours, because if resorted to too frequently it will irritate the skin.

The scald or burn produced by mustard is peculiar in its slowness to heal and in the fact that it is tender and reddened for days. Often it produces a permanent stain of the skin. If the burning of the mustard becomes excessive, it should be treated by applying a piece of lint soaked in lime-water and olive oil, half-and-half, or olive oil alone may be used.

The oil of mustard is very irritant, and almost epispastic in its effects. It is sometimes given in the treatment of the atonic stomach of drunkards in the dose of $\frac{1}{4}$ to $\frac{1}{2}$ minim (0.015–0.03). *Emplastrum Sinapis*, U. S. and B. P., or mustard-papers, are sometimes called *sinapisma*, and these afford a ready means of applying this counterirritant. They are generally very strong, and one or two layers of thin and moistened linen should be placed between the skin and the sinapism to prevent too great an action. (See Counterirritation.) The compound liniment (*Linimentum Sinapis Compositum; Linimentum Sinapis*, B. P.) is composed of the oil of mustard, castor oil, extract of mezereum, and alcohol. The mezereum is omitted in the British preparation, which is twice as strong in mustard oil as that used in the United States.

MYRRH.

Therapeutics.—Myrrh, which is a resin, in medicinal amount, is a stimulant to the circulation and to the uterine and the bronchial mucous membranes.

In *amenorrhea* due to functional inactivity or *anemia*, "iron and myrrh" is a standard remedy. (See Iron.)

The tincture of myrrh, diluted one-half, is useful in *ulcerated sore-throat* as a gargle, and the pure tincture is sometimes applied with a small brush or by the end of the finger to *spongy* or *tender gums*.

In *leucorrhea* depending upon uterine trouble and in *chronic cystitis* myrrh is often of service. Sometimes it enters into expectorant mixtures given in the *later stages of bronchitis*. The dose of the tincture (*Tinctura Myrrhæ*, U. S. and B. P.) is 10 to 30 minims (0.6–2.0), ½ to 1 fluidram (2.0–4.0), B. P. It also enters into the composition of *Pilulæ Aloes et Myrrhæ*, B. P., dose two to five pills, and *Tinctura Aloes et Myrrhæ*, the dose of which is 1 to 2 fluidrams (4.0–8.0).

NEOARSPHENAMINE.

Neoarsphenamina, U. S., differs from the older remedy arsphenamine (which see) in the following facts: It is not a combination of dioxidiamidoarsenobenzol with hydrochloric acid, but with sodium methanalsulphoxylate. It is very soluble in distilled water, and as it has a neutral reaction it does not have to be neutralized by sodium hydroxide. Neoarsphenamine comes on the market in hermetically sealed ampoules containing 0.15 gram, 0.3 gram, 0.45 gram, 0.6 gram, 0.75 gram and 0.9 gram. It is less deleterious to the patient, that is, less toxic than arsphenamine, and therefore can be safely given intravenously in larger doses, but gram for gram it is less destructive to the parasite, the relative efficiency being 0.9 neoarsphenamine to 0.5 arsphenamine. Even with these larger doses in some patients it is not as efficacious as the older drug, but the newer view is that the employment of smaller doses than heretofore as for example, 0.45 or 0.6 gm., is better practice even if it involves longer treatment. By this means the dangerous secondary effects of full doses are avoided and although fewer parasites may be destroyed per dose less endotoxin is set free per dose. When symptoms are severe these relatively small doses may be wisely continued with subcutaneous injections of bismuth. (See Bismuth.) (See Arsphenamine.)

Salvarsan was called "606," whereas neosalvarsan was called "914," as that number represents its position in the series of compounds made by Ehrlich. It resembles the older product in the following facts: It is readily oxidized, and must be prepared freshly for each injection and just before the dose is used. Often it does best in advanced syphilis if preceded by a course of mercury. It is capable, when given in full doses, of causing chills, fever, and impairment of heart action, and if the kidneys are inflamed may cause urinary suppression. In other words, the indications and contraindications to its use are identical with "606," but it is noteworthy it can be given in full dose in active syphilis as frequently as three times in a week, which is much more than is safe with the older drug.

Pijper has reported remarkably good effects from the use of this drug, given intravenously in full dose every day for 2 to 4 doses, in the treatment of *anthrax*. Serum is better. (See Antitoxin.)

In the sore mouth of *Vincent's angina* much good follows the use, in a swab, of a 5 per cent solution in glycerin. (See also Arsphenamine and Sulpharsphenamine.) This drug is also useful in obstinate cases of this infection if given intravenously.

Administration.—An easy method of administration is to remove the piston of a large glass syringe capable of holding 10 cc., and to place the neoarsphenamine in the barrel of the syringe, to which is added 4 to 8 cc. of sterile normal salt solution. The piston is replaced in the upper end of the barrel, and by gentle shaking a solution is obtained ready for injection. The solution should be warm but not hot. If the solution is not perfectly clear it should be filtered through sterile moist gauze. (See Arsphenamine.) The needle is attached to the syringe by means of a short piece of sterile rubber tubing. The arm having become congested by a hanging posture and by the use of a bandage or tourniquet, is placed in a horizontal position and the needle inserted into the bulging vein. A slight withdrawal of the piston draws the blood into the lower end of the syringe, proving that the vein has been entered, and this, having been determined, the injection is slowly performed over a period of not less than three minutes. If the skin has been properly sterilized, and the injection has not been into the wall of the vein no local trouble arises. The patient should rest quietly for some hours after the injection, if possible, and should not receive the injection immediately after a meal.

An even simpler method is to introduce 5 cc. of freshly distilled water into a glass syringe with its needle in place. Then open the ampoule containing the drug in the usual manner and after inserting the needle into the ampoule inject the water; withdraw the needle. Place a finger-tip, covered with a sterile finger-cot, over the opening and shake until the drug has formed a perfectly clear solution. Reintroduce the needle attached to the syringe and draw up the contents of ampoule which is then injected into the vein, it being recalled that the use of so strong a solution necessitates a very slow injection and that if the needle is not in the vein severe inflammation will follow. As much depends upon the use of a chemically pure distilled water there is now placed on the market ampoules hermetically sealed which are best used to dissolve the drug.

The solution should be freshly prepared before each injection, otherwise it may become toxic.

Always test the ampoule by immersing it in 95 per cent alcohol before opening it. If the powder in the ampoule is red instead of canary-yellow, or in lumps, discard it.

The doses usually increase in size. Thus the first dose for an adult is 0.9 gram; the second, 1.2 gram; the third, 1.35 gram; and the fourth, 1.5 gram. These doses may be given on every third day, or at longer intervals of ten days until a negative Wassermann test is secured. Seven days is a common interval. Women usually receive from 0.75 to 1.2 gram, children from 0.15 to 0.35 gram, and infants 0.05 gram.

The intramuscular dose is usually about 0.9 gram dissolved in 30 cc of sterile water. To avoid pain when it is used intramuscularly it is best to inject beforehand 2 or 3 cc. of a 1 per cent procaine solution. This method is rarely followed.

Neoarsphenamine is sometimes given by the rectum in the dose of 0.9 gram in 25 to 50 cc. of water.

Neoarsphenamine is more dangerous in hemorrhagic states, or where there is a gastric or duodenal ulcer tending to hemorrhage, than is arsphenamine.

It is also contraindicated in active tuberculosis, bronchiectasis and in the presence of acute colitis. (See Arsphenamine.) Patients who suffer from asthma, hay fever, urticaria and eczema are often unduly susceptible to this drug.

Not rarely where neoarsphenamine is given it almost at once causes the patient to complain of a disagreeable odor or nausea. This can be avoided by letting the patient use smelling salts or a strong perfume at the time the injection is given.

For other evil after effects see Arsphenamine. See also Sodium Thiosulphate for treatment.

NEOCINCHOPHEN.

Neocinchophen, or Tolysin, sometimes called Novatophan, is paramethylphenylcinchoninic acid ethyl ester. It is less irritating to the stomach than is cinchophen, and is used in the treatment of *gout* and *chronic rheumatic* conditions. It is also employed in *acute articular rheumatism*, and it is claimed by some clinicians that it is more efficient than the salicylates in the latter condition. To be effective, however, it must be given in larger doses than are ordinarily given to gouty patients, as much as 15 grains (1.0) every two hours for several doses, and after this every four hours. The dose ordinarily used is from 10 to 15 grains (0.65–1.0) three times a day, given in capsules.

How it acts in acute articular rheumatism is not known, and its action in gout is uncertain. It seems to possess definite pain-relieving properties, and it greatly increases the elimination of uric acid, but the uric acid is the result rather than the cause of gout and rheumatism. It is, therefore, a remedy which removes the results of the pathological process rather than influences the underlying pathological state. The elimination of the uric acid seems to be chiefly due to an action on the kidneys, and it does not mobilize uratic deposits already made. To aid in the elimination of uric acid, and to prevent its deposit in the bladder, bicarbonate of sodium should be given freely while it is being administered. This drug is contraindicated when there is a tendency to the formation of uratic calculi in the urinary tract and if the stomach is irritated. If the kidneys are diseased it fails to increase the output of uric acid but it does not seem to be as irritating to those organs as are the salicylates, although full doses in nephritic patients and in susceptible persons may induce nephritis. (See Cinchophen.) When full doses are given for as long as a week it is well to stop its use for several days not only to avoid renal irritation but also because its continued use may damage the liver cells.

Under the name *Atoquinol* a product is placed on the market in which the methyl radical in neocinchophen is replaced by the allyl radical. It is given in the same doses and for the same purposes.

NEOSILVOL.

Neosilvol is a colloidal silver iodide with a soluble gelatin base, and when applied to the tissues of the body is deposited as silver iodide. It is readily soluble in water if well shaken, and is used for the same purposes and in the same strength as silvol (which see). The advantage of neosilvol over silvol is that its solution is cream-white and not a very dark brown, as is that of silvol. A 6-grain capsule dissolved in 1 dram of water makes a 10 per cent solution. For *conjunctivitis* the strength is 10 per cent; for *gonorrheal ophthalmia*, 25 to 50 per cent as a prophylactic for *ophthalmia neonatorum* 25 per cent, 3 drops in each eye; for *coryza*, 10 per cent dropped into the nasal passages; for injection in *acute gonorrhea*, 5 per cent, or when irrigation is used 1 per cent. Neosilvol in 25 per cent solution is a useful application for so-called *fever blisters* if frequently applied. A solution should not be kept more than a week.

NITRATE OF SILVER.

Nitrate of silver (*Argenti Nitras*, U. S. and B. P.) is readily soluble in its own weight of water.

It is official as the pure nitrate (*Argenti Nitras*, U. S. and B. P.) and as the sticks or fused rolls (*Argenti Nitras Fusus*, U. S.), or lunar caustic. The latter are never used in medicine internally, only the crystals being employed. Applied to the tissues of the body or other substances, nitrate of silver causes a brown and finally a black stain, which is due to the formation of an oxide of silver.

Physiological Action.—Nitrate of silver is one of the few astringent substances which are applicable to inflamed mucous membranes, as it is, with lead, bismuth, and zinc, one of the few drugs of this class which is not irritant as well as astringent. Locally applied, it acts in pure form, as a powerful caustic, which is, very superficial in its effect, as the drug coagulates the albumin with which it comes in contact and thereby forms a coat which protects the tissues beneath.

The action of the drug upon the circulation, respiration, and similar vital functions is only partly known, and has no relation to its employment in medicine. It is eliminated from the system very slowly.

Poisoning.—Almost immediately after the ingestion of a poisonous dose of nitrate of silver violent pain in the belly, with vomiting and purging, is felt. At the same time evidences of widespread gastroenteritis develop. The abdominal walls are knotted and hard, and perhaps scaphoid. The face is anxious and livid and covered with a sweat. When vomiting occurs the ejecta are brown or blackish, or they may be white and curdy. The lips are at first white, but quickly become brown, then black. In some cases the nervous symptoms are severe, and convulsions with delirium may occur. The convulsions are epileptiform. Death ensues either from gastroenteritis or from centric respiratory failure, accompanied by a profuse exudation of liquid mucus into the bronchial tubes.

The treatment consists in the use of common salt, which is the chemical antidote, the employment of opium and oils to allay irritation, and in the ingestion of large draughts of milk and of soap and water for the purpose of diluting the poison and protecting the mucous membranes of the esophagus and stomach from the action of the irritant. The bodily heat must be maintained.

Chronic Poisoning.—This is a form of poisoning very rarely seen. The most prominent symptom is the pale slate-blue color of the skin, which causes the individual to be livid and death-like in appearance.

Argyria, as chronic silver poisoning is called, is caused by the continued employment of the drug until it is deposited in the tissues. It is then found in every part of the body. The first signs of discoloration can generally be seen in the darkening of the conjunctiva over the sclerotic coat of the eye or in a dark line on the inner part of the lips.

The treatment of argyria is not hopeful so far as the color of the skin is concerned, but the discoloration may be slightly modified in some cases by the prolonged use of iodide of potassium to aid in the elimination of the silver.

Therapeutics.—Internally this salt has been used as a cure for *gastric ulcer*, and it is a very useful drug if combined with extract of hyoscyamus or opium and given in pill form. In *chronic gastric catarrh* and *gastritis* nitrate of silver is very useful when the patient is troubled with sour eructations or when vomiting occurs after meals. When used in these states, it should be given in $\frac{1}{6}$-to $\frac{1}{4}$-grain

(0.1–0.015) doses, one-half to one hour before each meal, in order that the stomach may be exposed to its effects and not be protected by food.

In *intestinal ulceration* the drug was highly recommended by Pepper, and under these circumstances should be given in hard or keratin-coated pills, in order that it may pass through the stomach without being chemically changed. In *ulceration* of the *cecum* and *rectum* and in *acute* and *chronic dysentery* the disease may be attacked by rectal or colonic injections of nitrate of silver. If the cecum is involved, the solution must be given in large quantity in order to reach the part affected; but if the rectum is diseased, the amount of liquid injected should not exceed 4 ounces, the bowel in either case being washed out beforehand by warm water to rid it of feces. Soap and water and salt and water must not be used for this purpose, as the soap or salt which remains in the bowel will prevent the silver salt from acting. The strength of the solution employed should be 1 dram to 3 pints (4.0–1440 cc.) of water in colon trouble, and 3 grains (0.2) to each 4 ounces (120.0) in rectal trouble. If the latter condition is very obstinate and chronic, the strength may be increased to 5 grains (0.3) to each 4 ounces (120.0).

Whenever nitrate of silver injections are used in this way, a solution of salt and water should be ready for use, and injected if the action is too severe or as soon as it is thought that the drug has acted with sufficient thoroughness.

Nitrate of silver was at one time thought to be of value in *lateral* and *posterior spinal sclerosis*, but rarely does good.

Nitrate of silver has been largely used in *epilepsy* and *chorea*, but is now seldom so employed, and does little good in most cases.

Pepper thought highly of the continual administration of nitrate of silver in pill form in the dose of $\frac{1}{6}$ to $\frac{1}{4}$ grain (0.01–0.015) through the entire course of *typhoid fever*, and believed that it greatly modified the severity of the disease. This is doubtful.

Externally, nitrate of silver is used for many purposes, and will often prevent the *pitting of smallpox* if on the fourth or fifth day the vesicles are punctured by a needle dipped in a solution of nitrate of silver in the strength of 20 grains (1.3) to 1 ounce (30.0) of water. Others simply paint the skin over the eruption with a solution of 5 to 10 grains (0.3–0.6) to 1 ounce (30.0), claiming that this method is equally effective and prevents inflammation and suppuration.

Higginbottom has highly recommended the use of nitrate of silver upon *erysipelatous inflammations*, but the practice is not often resorted to, and is now supplanted by better measures. (See Erysipelas.) In other inflammations of a superficial character nitrate of silver is of great value. Painted in strong solution over the scrotum in the early stages of *orchitis* or *epididymitis*, it will often relieve the pain and diminish swelling, and *felons* may sometimes be aborted by its early application in concentrated solution over the surface of the finger.

In all inflammations of the *pharynx, larynx, fauces,* and *mouth* solutions of silver nitrate may be used in varying strength.

In *laryngeal phthisis* a spray, from an atomizer, in the strength of $\frac{1}{2}$ to 2 grains (0.03–0.12) to 1 ounce (30.0) of water may do good service.

In *whooping cough* Ringer recommends the use of a spray in the strength given above for the purpose of relieving the cough in violence and frequency and of obtaining a good night's rest. The applications should be made when the stomach is empty, as they are apt to bring on retching. The tip of the atomizer must be within the mouth or the skin of the face will be stained.

In the subacute stages of *gonorrhea* an injection of nitrate of silver of the strength of $\frac{1}{2}$ grain (0.03) to 3 ounces (90.0) of water is useful. (See Gonorrhea, Part IV.)

In *uterine ulceration* and in *leucorrhea* when the cervix is boggy and tender, the application of the solid nitrate of silver stick is of service. Its use is often followed by *headache* about the vertex, and this in turn is to be relieved by 10-grain (0.6) doses of the bromides.

In *pruritus pudendi vel ani* and *vulvæ* if the skin is not broken a solution of 4 to 6 grains to 1 ounce (0.25–0.4:30.0) should be painted with a camel's-hair brush over the parts to relieve the itching. The application is to be made from two to four times a day.

Bed-sores may be aborted if, as soon as the skin reddens, an aqueous solution of nitrate of silver of the strength of 20 grains to 1 ounce (1.3–30.0) is applied with a brush to the part. For obvious reasons this measure often fails in paralytics.

Boils which begin in a small limited papule with a surrounding area of inflammation may sometimes be aborted by painting a strong solution of this salt around them.

In *granular lids, conjunctivitis,* and similar affections about the eye nitrate of silver in stick form or in solution is largely and successfully employed. As a prophylactic for *ophthalmia neonatorum* it is invaluable, and in most cases a 1 per cent solution is adequate. If infection is present, 2 per cent should be used. The pain caused by the use of this salt in the eye can be modified by the addition to the ordinary watery solution of 15 per cent of glycerin, which seems to increase the penetrative and antiseptic effect of the drug. (See Conjunctivitis.)

When it is desired to remove nitrate of silver stains, they should be washed with a solution made of cyanide of potassium 2$\frac{1}{2}$ drams (10.0), iodine 15 grains (1.0), and water 3 ounces (90.0); or dissolve 15 grains (1.0) of corrosive sublimate in 7 ounces (210.0) of boiled water, add about 45 grains (3.0) of table salt (a scant teaspoonful) just before using, lay the stained materials in the mixture for about five minutes, and then wash them two or three times in pure water.

Administration.—The dose of nitrate of silver is $\frac{1}{6}$ to $\frac{1}{4}$ grain (0.01-0.015) in pill form. Mitigated caustic, or mitigated nitrate of silver

(*Argenti Nitras Mitigatus*, B. P.), is composed of equal parts of nitrate of silver and potassium nitrate, and is good as a mild caustic.

The drug when given continuously should be discontinued for two weeks at the end of the eighth week, as it is so slowly eliminated that it accumulates in the body and causes argyria; but Lewin and Soullier assert that the smallest aggregate amount on record which has produced argyria is 1 ounce.

NITRIC ACID.

Nitric acid (*Acidum Nitricum*, U. S. and B. P.), the strongest and most corrosive of the mineral acids used in medicine, is a clear liquid, becoming slightly yellow with age. It should be kept in dark, glass-stoppered bottles.

Physiological Action.—When in pure form, nitric acid acts upon the tissues of the body as a powerful caustic. Applied to the mucous membranes, well diluted, it acts as an irritant or astringent, and when taken internally it exerts a stimulating influence over the secretory glands of the stomach and small intestine. It does not tend to relax the bowels, as does nitro-hydrochloric acid. Continued for a long period of time in small doses, it is said to cause slight salivation and looseness of the teeth. Nitric acid coagulates albumin.

Poisoning.—When nitric acid is taken in concentrated form, it produces a widespread gastro-enteritis, intense pain in the mouth, esophagus, and abdomen, and finally death from the inflammation induced or from collapse. If the patient survives the acute stages, he may die from secondary changes in the stomach and bowels, such as stricture or destruction of the peptic tubules. The stain made by the acid about the mouth and on clothing is deep lemon-yellow. Renal irritation is often a severe symptom, and the urine and the passages from the bowels may be bloody.

The antidotes are any mild alkali, as magnesia, chalk, or plaster from the walls of the room, the use of oils and opium to relieve irritation, and the maintenance of bodily heat.

Therapeutics.—Nitric acid is used externally in medicine as a caustic for *chancres* and *chancroids*, the surrounding tissues being protected by oils or ointments.

Nitric acid may also be used on *warts*, in cases of *gangrene* to destroy the tissues, and on *phagedenic ulcers*. Whenever the acid is to be applied for such purposes, a solution of sodium bicarbonate and water should be at hand to neutralize the effects as soon as it has acted deeply enough. Nitric acid is also used externally in a dilute form, 5 to 30 minims to 1 ounce (0.3–2.0:30.0) of water, as a stimulant and astringent to *indolent ulcers*.

Internally, nitric acid is used as a tonic and astringent. In the *oxalic-acid diathesis* when oxaluria is present, nitric acid will give relief when nitromuriatic acid cannot be obtained, although the latter is preferable. When *small ulcers* exist in the mouth or *stomatitis* is present, 3 minims (0.2) of nitric acid at a dose, in water, will often be of service, but it should be taken through a tube to protect the teeth. In *gastric indigestion* in which, sometimes after a meal, undigested food regurgitates into the mouth, a few drops of nitric acid in water after meals will often give relief. In *intestinal dyspepsia* coming on some hours after meals, and in which not only discomfort but pain may be felt in the hypochondrium, nitric acid with some bitter tonic is most efficient, and it will often cure the *green diarrhea* of children, particularly that met with in summer, bringing about these changes not only by its astringent power, but also by its stimulating effect on the intestinal glands. Combined with some good pepsin, it will give relief in the *chronic diarrhea* of children associated with *lientery*, and in which the stools may be pasty or watery and at the same time ill-smelling.

Ringer recommends the employment of nitric acid in the treatment of *piles*. The strong acid should be used, and simply touched to one or two points, not swept over the whole surface. The pain is slight, or none at all may be felt. A slough results, and finally comes away, leaving a cicatrix which as it contracts diminishes the size of the pile.

The same author also states that a lotion of nitric acid in the proportion of ½ to 1 dram to 1 pint (2.0-4.0:480 cc.) of water is of service in *bleeding hemorrhoids*, arresting the bleeding, constringing the parts, and relieving the sensation of weight and fulness so often a pressing symptom.

The dose of dilute nitric acid (*Acidum Nitricum Dilutum*, B. P.) is 3 to 15 minims (0.2–1.0), well diluted, and taken through a tube to protect the teeth.

An exceedingly strong preparation, *Acidum Nitricum Fumans*, is official in the B. P.

NITRITE OF POTASSIUM.

Nitrite of potassium is a salt used largely in modern medicine to take the place of nitroglycerin, as it possesses greater stability, and is therefore more lasting in its effects (Fig. 58). It is used for the relief of *angina pectoris* or *heart-pang*, in the treatment of *gastralgia* and in *epilepsy*. The dose is from 3 to 5 grains (0.2–0.3), although much larger doses have been employed. These larger doses are, however, not devoid of danger. Nitrite of potassium is eliminated by the lungs and by the kidneys as a nitrate. (See Nitroglycerin.)

Cobalto-nitrite of Potassium.

This preparation has been employed successfully as a substitute for the nitrite of potassium. As it is a more stable compound, it is less rapidly broken up in the system, and so exercises a more prolonged influence. For this reason it does not act so vigorously or suddenly, which is a great advantage in some cases. Its use is identical with that of the rest of the nitrite group. The dose is ½ grain (0.03) every three hours.

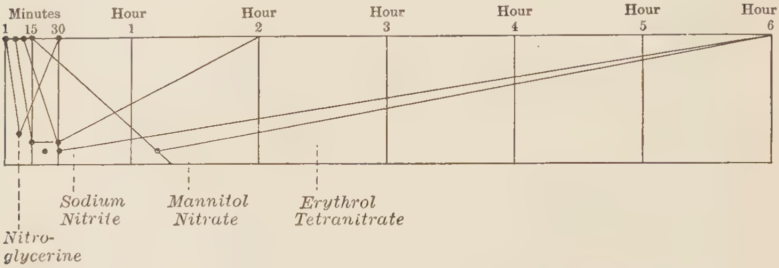

FIG. 58.—Showing length of effect of different nitrites.

NITRITE OF SODIUM.

Sodium nitrite (*Sodii Nitris*, U. S. and B. P.) is used for the same purposes as nitrite of potassium in the dose of 1 to 2 grains (0.06–0.12) given in pill or cachet. If exposed to the air it deliquesces, gradually oxidizes, and becomes unfit for use. This is probably the best of all the nitrite preparations for cases of *persistent high arterial tension.* It is best given in capsule with sodium bicarbonate. (See Nitroglycerin.)

NITROGLYCERIN.

Nitroglycerin, sometimes called trinitrin or glonoin, is a compound which, in its pure state, is used largely as an explosive, but it is employed in medicine in a dilute form as a useful drug in those instances where a somewhat rapid and powerful effect is to be exercised over the vascular system. As its influence lasts but a short time, it should be given every three or four hours. Its physiological action is identical with that of the other nitrites, such as the amyl nitrite (which see), except that it is not so violent or fugacious as the latter nor so persistent in its effects as the nitrites of sodium and potassium. The dose is 1 to 2 minims (0.05–0.1) of a 1 per cent alcoholic solution (*Spiritus Glycerylis Nitratis*, U. S. P.) in a little water or in a pill, after the patient has taken the remedy for a considerable period of time, as much as 60 minims has been administered, as the system rapidly becomes accustomed to its effects. Often good results are obtained only by giving ascending doses. It is noteworthy that patients rapidly become immune to the drug, and Reading has recorded a case in which, after a year of treatment, 1 dram (4.0) of a 10 per cent solution was taken daily with good effect. The author has given as much as 1¼ grains a day.

The drug is largely employed in *angina pectoris* (see Part IV), and sometimes in *epilepsy* and *chorea* and in *gastralgia*. J. M. DaCosta and others have highly commended this drug in the treatment of *chronic parenchymatous nephritis,* as it distinctly decreases the excretion of albumin from the kidneys. In *interstitial nephritis,* with cardiac disturbance resulting from the renal changes, in which there is a marked increase in arterial pressure, so that auscultation reveals at the second right costal cartilage an accentuated second sound due to the forcible closure of the aortic leaflets, nitroglycerin often produces a good effect by reducing the pressure and relieving the heart of strain. This use of the drug is one of its most important applications. (See article on Heart Disease, in Part IV.) It is when attacks of angina pectoris seem to be accompanied or preceded by marked vascular spasm that nitroglycerin is chiefly indicated. Nitroglycerin given hypodermically in the dose of $\frac{1}{100}$ to $\frac{1}{50}$ grain (0.0006–0.0012) is one of the best remedies for *hemoptysis.* (See Amyl Nitrite.)

In cases of *asthma* dependent upon spasm and engorgement of the mucous membranes of the bronchial tubes it is serviceable. Humphreys asserts that nitroglycerin is a most valuable drug in *vomiting* of all kinds, except that of pregnancy and peritonitis. Given in the dose of $\frac{1}{200}$ grain (0.0003) hypodermically with morphine it prevents the after-nausea sometimes produced by that drug.

Nitroglycerin usually causes a considerable increase in urinary flow by reason of the relaxation of the renal bloodvessels which it produces, particularly those vessels forming the Malpighian tuft.

Because nitroglycerin relaxes arterial tension and so relieves the heart of a certain amount of labor in cases characterized by high arterial tension, thereby doing good when the heart is tired because of the labor required of it, many physicians have come to employ it as a cardiac stimulant in acute diseases without high tension of the bloodvessels. There is no justification for this use of the drug, for it is not a stimulant.

The 1 per cent solution used in medicine is too weak to be explosive. Tablets of nitroglycerin (*Tabellæ Trinitrini,* B. P.) each contain $\frac{1}{130}$ grain (0.0005). The *Spiritus Glycerylis Nitratis,* U. S., is a 1 per cent alcoholic solution of glyceryl trinitrate. It should be kept in tightly-stoppered tins, never in glass, and be stored in a cool place, away from heat. Its explosiveness is in direct ratio to the evaporation of its alcohol. If it is spilled in any quantity so that the alcohol can evaporate and so leave nitroglycerin in concentrated form it should be decomposed by pouring over it a solution of potassium hydroxide. The dose of the spirit is the same as that of the watery solution, namely, 1 to 2 minims (0.05–0.1). *Liquor Trinitrini,* B. P., is practically identical with the spirit just named, and is given in the same dose.

Erythrol Tetranitrate.

Erythrol tetranitrate is a white crystalline substance, soluble in alcohol, but insoluble in water. It is explosive on percussion or trituration, and is employed in medicine in the place of nitroglycerin for the purposes just named. Its action is slow in developing and more prolonged in its effects. It is therefore not suited for the relief of attacks of angina pectoris, but useful when a prolonged effect is desired. Its dose is $\frac{1}{4}$ to $\frac{1}{2}$ grain (0.015–0.03), given in solution or in tablets.

NITRO-HYDROCHLORIC ACID.

Nitro-hydrochloric acid (*Acidum Nitro-hydrochloricum*, N. F.) is a liquid giving off a distinct odor, possessing caustic power, which stains the tissues of the body a light yellow. It is employed in the form of the dilute acid (*Acidum Nitro-hydrochloricum Dilutum*, N. F. and B. P.), in which form it is useless except as an ordinary acid. When it is desirable to use the acid for its own peculiar effects, the dilute acid ought always to be supplanted by the freshly mixed strong acid, which should be of an orange color. If this cannot be obtained, the physician should prepare the compound himself by adding 4 parts of medicinally pure nitric acid to 16 parts of hydrochloric acid, and allowing the mixture to stand in an open bottle until fumes are no longer given off in excess, when it should be tightly corked and kept in a dark place. This acid should be freshly prepared every few days.

Poisoning.—The symptoms caused by poisonous doses are those of violent gastro-enteritis with vomiting and purging of bloody materials. Death may occur from perforation of the alimentary canal, from inflammation of the abdominal viscera, and from destruction of the peptic tubules or constrictions of the esophagus or bowel. The treatment consists in the use of alkalies, such as magnesia, lime, plaster, soap, and oils, with opium to allay irritation. The use of external heat to prevent collapse is also to be resorted to.

Therapeutics.—Nitro-hydrochloric acid is an invaluable remedy in many cases of *indigestion* arising either in the stomach or bowels, as it acts as a tonic and stimulant to secretion. Upon the biliary flow its action is marked, and it may even cause bilious purging if administered in full doses for some days. It is therefore largely used in *hepatic torpor*, either acute or chronic, and in the early stages of *hepatic cirrhosis* should always be resorted to. In the *chronic hepatitis* of hot climates it is exceedingly useful, but it is not to be employed in acute sthenic hepatitis, as it is a stimulant to the liver, which, under these conditions, needs quieting. When used in *chronic hepatitis* it should be given in full dose and pushed to its physiological limit, as evidenced by the bilious purging produced or by signs of gastro-intestinal irritation.

A useful additional means for obtaining the beneficial effects of this acid is to use it by means of the foot-bath or general bath. As used by Johnson in India, the acid for this bath is prepared by slowly and carefully adding together 2 parts of nitric acid and 3 parts of hydrochloric acid, and after twenty minutes mixing carefully with these distilled water 5 parts. For a general bath (in a wooden tub) take 5 pailfuls of water, 64 fluidounces (2 liters+) of the acid mixture, and enough boiling water to raise the temperature to 98° F. Keep the patient in the bath twenty minutes. Then rub him thoroughly with warm towels and place him in a dry, warm bed. For the foot-bath add 6 ounces (180.0) of the acid to 2 gallons (7 liters) of water at 98° F., and bathe the thighs and calves of the legs for twenty minutes with a sponge wet with the mixture. This is a very useful treatment, according to Stillé, for cases of *alcoholic hepatic torpor.* If in either case the skin becomes irritated, less acid is to be used.

In ordinary so-called *biliousness,* which is not biliousness but intestinal indigestion, this acid is often of great service. (See Indigestion and Biliousness.) It is also of value in *lienteric diarrhea* where the condition results from defective secretory action on the part of the glands which pour out the proper fluids for digestion. Several authors, notably Beckman, assert that if the strong acid is given in the dose of 10 minims (0.65) after each meal and at midnight it is specific in *hay fever,* relief coming within twenty-four to forty-eight hours.

Administration.—The strong, freshly mixed acid should be given to the adult in the dose of 3 to 5 minims (0.2–0.3) three times a day, well diluted, and taken through a tube, after meals. If the patient is intelligent, he should be ordered ½ ounce (16.0) of the pure acid and told how to drop it. If he is not, the physician should order it partly or entirely diluted in the prescription, and in so small an amount that it will be renewed before it loses any of its power. Warning should be given of its effects on clothing with which it may come in contact, and care should be taken that the bottle is held some distance from the face when the cork is withdrawn, as the acid, if freshly mixed, may spurt and burn the eyes and skin.

NITROUS OXIDE.

Nitrous oxide, or *Nitrogenii monoxidum,* U. S., is sometimes called protoxide of nitrogen, or "laughing gas." Its power to relieve pain was first recognized by Sir Humphrey Davy more than one hundred years ago. As with ether, so with nitrous oxide, its first use as a surgical anesthetic was by an American, Horace Wells, a dentist.

The gas is devoid of odor, but possesses a slightly sweet taste. It may be kept in gaseous form, or in liquid form and allowed to become gaseous as it is used. It is marketed in cylinders, after careful preparation to eliminate impurities. It is under such pressure that 66 per cent is liquid in form and 34 per cent gaseous, and if free nitrogen is removed to the degree that is proper it should not be present in excess of 1 to 2 per cent. (See Gas Oxygen next page.) Owing to the symptoms sometimes produced in persons inhaling this gas, it has received the popular name of "laughing gas," but a condition of hilarity is rarely seen when the inhalations are full and deep, and only comes on, in the majority of cases, when the gas is given in small amounts or inhaled very slowly.

Physiological Action.—According to some careful studies upon the action of this gas (Kemp), it has no direct effect on the heart and vasomotor system, but indirectly it causes a rise of arterial pressure by the slight asphyxia which is produced. The anesthesia is due in part to the non-oxygenation of the blood during the time the gas is in this fluid, but the gas chiefly produces anesthesia by a direct action on the cerebral cortex. It is a curious fact that the conjunctival reflex is often preserved after general anesthesia is present.

Owing to the fact that when pure it is devoid of depressant effects and irritant properties, this gas can be used when ether and chloroform are contraindicated.

Nitrous oxide gas rarely produces any disagreeable after-effects, save a slight light-headed sensation or dizziness lasting for a few hours. (For statistics see article on Ether.)

Therapeutics.—When used properly, the patient is directed to take long, deep inspirations from the tube placed in the mouth, the nose being held so that the nostrils are closed, or a transparent mask, provided with a valve for the escape of the expired air, is applied over the mouth and nose. The gas is then allowed to enter the mask and is inhaled from it. Under these circumstances the face becomes for a moment flushed, then of a deadly pallor, and finally the jaw drops if the effect is complete. At this time anesthesia is complete and the operation is to be rapidly performed.

Nitrous oxide is a useful anesthetic in all minor operations, such as opening an abscess, boil, or felon, or even amputating a digit. It is used by many surgeons at the present time for the purpose of beginning an anesthesia which is to be continued by ether or chloroform, since the rapidity with which it produces anesthesia prevents the disagreeable preliminary symptoms induced in many persons by these drugs. This is particularly advantageous in nervous women and children.

The gas possesses three disadvantages: the first of which is its brevity of action, the other the difficulty in carrying it from place to place. So too it often fails when complete relaxation is needed as in abdominal operations. It possesses a great advantage in almost absolute safety, very few deaths having been caused by it directly. It is the safest of all anesthetics, not even excepting local anesthetics, which latter have largely supplanted the gas for many minor surgical operations.

When teeth are to be extracted, a plug or cork is placed between the jaws before the gas is given to keep them apart. The cork should always be attached to a string, so that if it slips into the back part of the mouth it can be withdrawn before it chokes the patient. Jaw forceps may also be employed.

The combination of nitrous oxide and oxygen-gas has almost completely supplemented the gas by itself, since the oxygen enables the anesthetist to prolong the anesthesia almost indefinitely and the patient is never more than "just under." By the simultaneous use of oxygen the rise of blood-pressure ordinarily induced is put aside. Particularly is it useful if very weak solutions of some local anesthetic, like Schleich's fluid or a 0.25 per cent procaine solution, is used simultaneously, the entire field of the operation as it proceeds being infiltrated as nearly as possible along the lines of its nerve supply. In other instances a preliminary injection of morphine and atropine, or scopolamine, is given. Many physicians, particularly those attached to maternities or hospitals in which assistants trained in the use of this gas are present, are using with good results nitrous oxide gas to relieve the pains of *childbirth.* If given skilfully there is no danger to the mother and but little danger to the child, but it *must* be given skilfully. Asphyxia of the new-born may be present if it is carelessly used. Properly given it does not interfere with uterine contractions during or after labor.

Many anesthetists use an apparatus by which nitrous oxide, oxygen and ether can all be used, and for prolonged anesthesia such a combination is without doubt the best. (See Figure under Ethylene.)

Although nitrous oxide is so safe, it cannot be given by a tyro, for anything except momentary anesthesia, with success. If employed as an ordinary surgical anesthetic it must be given by a trained anesthetist, or the anesthesia when once induced maintained by ether. It has been well said that it is easier for a tyro to learn by adding N_2O to ether than to learn by adding ether to N_2O. Flemming, of London, states that N_2O and oxygen without ether, or other relaxant, is prone to cause serious cardiac and respiratory embarrassment in the presence of high or low blood-pressure, and in those suffering from extreme weakness or toxemia abdominal manipulation is prone to cause sudden syncope. It does badly in stout elderly persons. Because of the small tidal volume of young children it is usually to be avoided as an anesthetic in this class of patient until they are old enough to have a tidal volume of 300 to 400 cc.; that is usually at ten to twelve years, but if skilfully given with oxygen there are many professional anesthetizers who assert it is the anesthetic of choice in children over four years. If surgical anesthesia is needful it is the best anesthetic for those who have tuberculosis, renal disease, or acute infections of the air passages.

Administration.—As already stated, more training and skill are needed to produce satisfactory anesthesia for surgical purposes by nitrous oxide than when ether is employed. When nitrous oxide and oxygen gas is used as an anesthetic it must be given without any air being admitted to the inhaler. The inhaler fits closely to the face and by means of valves the gases gain access to the lungs during inspiration, but during expiration the expired air and gases escape into the room or into a rubber bag so that rebreathing may be well practised. The object in using a closed inhaler is to exclude atmospheric air which, as it contains 80 per cent of nitrogen gas will greatly reduce the proportion of N_2O inhaled. The needs of the tissues for oxygen are met by the simultaneous use of from 6 to 10 per cent of that gas. Such a combination results in anesthesia developing more slowly than if the N_2O is given by itself, but this slight delay (four to eight minutes) is compensated by the avoidance of excitement or other disagreeable symptoms. The too free use of oxygen may permit such symptoms however. In such a condition the quantity of N_2O must be increased and the oxygen decreased. When a child is treated the oxygen should be from 15 to 25 per cent. If the quantity of N_2O is too great there may be masseter and respiratory spasm. A little air should then be admitted at the sides of the mask for a few respirations. N_2O should not cause more than momentary cyanosis. If it occurs stop the N_2O and use oxygen, or if respiration is feeble, give carbon dioxide. (See Carbon Dioxide.) An important point to remember is that no fixed quantity of any gas is indicated in every patient. The amounts vary with each patient and from time to time in each individual.

If the operation is a prolonged one, it is advisable to permit some atmospheric air to enter at the sides of the inhaler occasionally in addition to the oxygen.

In one type of apparatus under the openings marked "oxygen meter" and "N_2O meter," which are covered with glass, there are disks, each of which is actuated by the flow of gas. On the periphery of each disk there is a scale which enables one to judge the rate of gas flow. The disk measuring the oxygen flow is calibrated to a flow in steps of 0.1 liter per minute up to 2.5 liters per minute. The nitrous oxide disk is calibrated in steps of 1 liter per minute up to 12 liters per minute. The calibration of the disks differs because the amount of oxygen employed is far less than that of nitrous oxide. By these disks the quantity of the oxygen and nitrous oxide which a patient is receiving can be estimated, and the quantities varied according to the degree of anesthesia and the condition of the patient. By means of the stop-cock shown in the illustration ether can be added to the gases and, by means of the "safety heater," the ether may be warmed without danger of exploding. During anesthesia a flow of oxygen amounting to about 0.5 liters per minute is usually employed, but larger quantities may be used if need be. The nitrous oxide is usually given at the rate of from 6 to 10 liters per minute. (See Ethylene for illustration.)

Contraindications.—The gas alone ought not to be given to those who are advanced in years or have atheromatous bloodvessels, since the rise of arterial pressure consequent upon the asphyxia may rupture a cerebral bloodvessel and thereby cause an apoplexy; but if oxygen gas is properly given with it this danger is largely put aside, for except in rare cases the pressure does not rise.

NOVASPIRIN.

Novaspirin is a white powder possessing a faint acidulous taste, but without odor. It is practically insoluble in water, but readily so in alcohol. It contains 62 per cent of salicylic acid and its chemical name is *methylene-citryl-salicylic acid.* As it is supposed to pass through the stomach unchanged, it may be employed interchangeably with salol or acetylsalicylic acid when the gastric disturbances produced by the ordinary salicylates contraindicate their use. When it comes in contact with the alkaline juices of the intestines it is decomposed into salicylic acid and methylene citric acid. It is less irritating than aspirin.

The uses of novaspirin are practically identical with salol and aspirin, namely: in *influenza, tonsillitis, intestinal fermentation, neuralgia,* and in both *muscular* and *acute articular rheumatism.*

The ordinary dose for an adult is from 8 to 15 grains (0.5–1.0). As much as 60 grains (4.0) or more may be given in twenty-four hours, if necessary, to combat rheumatism.

NOVASUROL.

Novasurol or Merbaphen is the double salt of sodium mercuri-o-chlorphenoxyloxyacetate and diethylbarbituric acid. Its content of mercury is about 34 per cent and it is employed only in the form of a 10 per cent sterile solution in ampoules. It causes a remarkable increase in the flow of urine in some cases of *cardiac dropsy* and *ascitis* and I have seen it establish renal flow in instances of postoperative *anuria.* There is usually a marked increase in the elimination of sodium chloride. Because of its mercury content it is contraindicated in the presence of any form of nephritis and in the presence of intestinal inflammation. Experiments by Lazarus-Barlow indicate that merbaphen has a special affinity for the central lobules of the liver and when hepatic disease is present, or prolonged hepatic congestion has resulted, in cases of cardiac failure, it should not be given. Johnstone has also shown that full doses may cause renal changes identical with those of mercury bichloride. The dose of novasurol is commonly stated to be 1 to 2 cc. (1–2 ampoules) and not repeated for at least three and preferably five days, but it is often wise to give not more than 0.5 at least for the first dose. It is not to be given hypodermically but intramuscularly as it is too irritating for subcutaneous use. It may also be administered intravenously very slowly. This plan is better if edema is widespread. If it fails to produce diuresis full doses of ammonium chloride should be given to act as an adjuvant (see Ammonium Chloride).

Merbaphen may be used by reason of its mercury content in the treatment of *syphilis.* Indeed it was introduced into medical practice for this purpose. Unfortunately its injection is followed by considerable pain. When given too freely it may produce an outbreak of petechiæ or cause fairly widespread ulceration of the colon. In other instances collapse has followed its use. Perhaps the best statement as to its use is that it is to be used in cardiac dropsy only after digitalis has failed.

SALYRGAN.—This is a compound nearly related to merbaphen, or novasurol. It is a 10 per cent solution of mercury salicylallylamide-o-acetate of sodium. It is used for the same purpose as novasurol (see above). It is best given in the dose of 0.5 cc. intravenously one to three times a week. If 0.5 cc. fails increase the dose up to 2 or 3 cc. As a rule diuresis begins in from one to four hours and lasts eight to twelve hours. If it does not act chloride of ammonium in very full doses, up to 2 or 3 drams a day at least, are given by the mouth. As 30 per cent of salyrgan is mercury the patient should be watched for mercurialism. Like novasurol it is contraindicated in the presence of renal disease. Its field is *cardiac dropsy* and for *ascites* due to hepatic cirrhosis. Salyrgan may be injected intramuscularly, but so given is not as effective as if it enters by a vein. Both these preparations lose power after a time in some instances.

NOVOCAINE.

(See PROCAINE.)

NUTMEG.

Myristica, U. S. and B. P., or nutmeg, is the kernel of the ripe seed of *Myristica fragrans,* an East and West Indian plant, mace being the outside covering of the same. Nutmeg is a soporific and nervous sedative, exercising a peculiar influence over the cerebrum. It is also used as a flavoring substance in somnifacient mixtures, and is of value in prescriptions for *serous diarrhea.* The oil (*Oleum Myristicæ,* U. S. and B. P.) is given in the dose of 1 to 3 minims (0.05-0.2). The spirit or essence (*Spiritus Myristicæ*) is used in the dose of 1 to 2 fluidrams (4.0–8.0).

Several instances of poisoning by nutmeg are reported; a severe case by Dr. Reading, of Woodbury, N. J. The symptoms closely resemble those produced by excessive doses of cannabis.

NUX VOMICA.

Nux vomica (U. S. and B. P.) is the seeds or beans of *Strychnos Nux-vomica*. It contains two alkaloids, strychnine and brucine, and depends largely for its medicinal power on the former. For this reason the statements made in regard to the physiological action of strychnine may practically be considered as applicable to the entire drug.

Physiological Action.—When strychnine is given to man or the lower animals in full medicinal dose it increases reflex activity, respiratory rate, pulse-force, arterial pressure, the acuity of smell, vision, and hearing, and causes general systemic irritation or excitement.

Nervous System.—On the nervous system strychnine exerts its chief influence. It excites the spinal cord in its motor tracts, and probably increases the receptive activity of the sensory centers. It also has some slight influence in increasing the conductive power of the motor and sensory nerves.

In overdose strychnine produces spinal or tetanic convulsions by an action exerted on the spinal cord. When enormous doses are given intravenously, total paralysis, resembling that caused by curare ensues, and if artificial respiration is not used the animal dies from failure of respiration. If death takes place from the effects of the drug, the motor nerves are found to be depressed, partly as the result of the poisonous action of the strychnine, and partly as the result of the exhaustion of the nerve-trunks by the convulsing impulses which they have carried (Fig. 59).

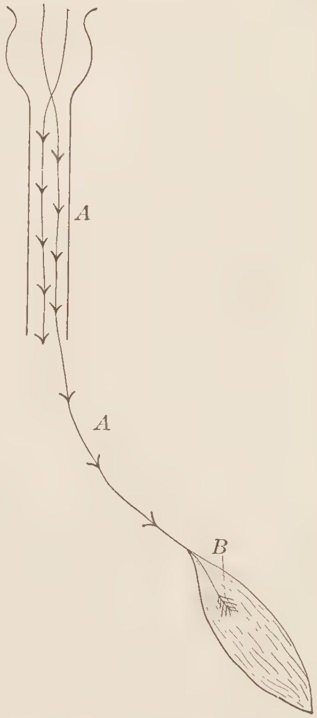

Fig. 59.—*A*, nux vomica stimulates the motor tracts in the spinal cord and to a slight extent the nerve-trunks; *B*, in large, poisonous doses it depresses the motor nerve-plate in the muscle and exhausts the nerve-trunks.

Circulation.—Nux vomica increases the force of the pulse-beat and the pulse-rate by a stimulation of the heart muscle, while the rise of arterial pressure which it causes is due to stimulation of the vasomotor center.

Respiration.—Strychnine is one of the most constant and powerful stimulants of the respiratory center that we have, and it not only increases the rate of respiration, but also the respiratory depth.

Temperature.—Ordinary doses have no effect upon temperature, but poisonous doses may raise it by reason of the convulsions.

Elimination.—Strychnine is eliminated from the body by the kidneys as strychnine and strychnic acid. Most of it is oxidized and destroyed by the liver.

Therapeutics.—Nux vomica, or its chief alkaloid strychnine, is used for several purposes in medicine. Owing to its bitter character, it may be employed as a simple bitter tonic or as one especially influencing the nervous system. It may also be used as a respiratory, cardiac, and ocular stimulant.

In cases of *functional nervous atony*, or depression, strychnine does good; but in organic disease of the nervous system, if used during the period of acute inflammation, as, for example soon after an apoplexy or in acute infantile palsy, it is distinctly harmful. Some persons who have suffered from apoplexy can never take the drug without a spasm coming on in the paralyzed part or parts, probably through irritation of the degenerated pyramidal tracts. In acute or subacute neuritis strychnine ought never be used, as the nerves are already inflamed, and are not to be still further irritated by the employment of nerve excitants. In *progressive lead palsy* large doses of strychnine should be constantly used to check the progress of the disease, iodide of potassium also being employed to cause elimination of the lead.

In *amaurosis* dependent upon the excessive use of tobacco or alcohol strychnine is almost a specific, and in eye-strain resulting from insufficiency of the ocular muscles it does great good, curing the insufficiency and improving the general condition of the muscles. According to de Schweinitz, the patient should use ascending doses of the tincture of nux vomica, beginning with 10 minims (0.65) three times a day, and increasing the amount 2 minims (0.1) a dose until distinct physiological effects are produced. Sometimes 60 minims (4.0) or more may be taken in twenty-four hours.

Experiments by the author indicate that constantly increasing doses, instead of decreasing the person's susceptibility to the drug, actually increase it, so that a large but moderate dose produces greater effects after some days of use than a full dose does at first.

In *pneumonia* and all other acute diseases in which sudden collapse is liable to occur strychnine is of the greatest service at the time of need. Often it will pull the patient out of a sinking attack which seems certain to end in death. It should be used freely by the hypodermic needle, and is often aided in producing its good effects by the addition of $\frac{1}{150}$ to $\frac{1}{100}$ grain (0.0004–0.0006) of atropine to each injection. (See Pneumonia and Shock.)

The author desires to protest most emphatically against the common practice of the day, which consists in the use of strychnine as a circulatory stimulant through prolonged exhausting illness. It is essentially a whip to the flagging heart, to be used at a crisis, but not continued for days. Cases are constantly seen in which the persistent use of the drug in fever produces a rapid running pulse and great nervous irritation and prolongation of the febrile movement.

There is no drug known which is so antidotal to the effects of overdoses of chloroform as is strychnine. In cases of sudden accident, with arrest of the heart or respiration during the use of this anesthetic the physician should give an intramuscular injection of $\frac{1}{20}$ grain (0.003) of strychnine as a powerful, rapidly acting cardiac and respiratory stimulant, which dose may be repeated in ten minutes if no effect is produced.

The use of strychnine as a stimulant in surgical *shock* has been criticized on the ground that it is valueless if the vasomotor center is paralyzed. This would hold true if the center was paralyzed; in most cases, however, it is only depressed, and strychnine does good if the operation or accident is past. Given before operation to prevent shock its use is unwise in that, by stimulating and exciting the nervous system, it renders it more susceptible to shock and injury. Oftentimes the apparent collapse of a recuperating patient is due rather to intense nausea than to the shock, and the free use of this drug is not necessary.

It is a better antidote to opium than is belladonna.

In *dyspnea* from any cause, such as that of old persons suffering from *bronchiectasis* or *emphysema*, in *tuberculosis*, and in *shortness* of breath, strychnine is of service, and it is a valuable drug for the treatment of *opium poisoning*, because it preserves the reflexes and stimulates the respiratory center.

In *atony of the bowels* strychnine is of service, and it is to be added to purgative pills to avoid their depressing after-effects on the intestines.

In cases of *hemiplegia*, after the acute stage is passed, strychnine may be used to keep up the nutrition of the limbs, which are paralyzed; but if the paralysis be due to disease of the trophic cells in the spinal cord, it does little good except to stimulate the remaining cells to greater effort.

According to Ringer, *sick headaches*, due to errors in diet and without much nausea, can be relieved for the day by the use of 1 minim (0.05) of the tincture of nux vomica in a teaspoonful (4.0) of water every five or ten minutes until 10 minims (0.6) are taken.

Strychnine possesses no curative properties in chronic alcoholism. Owing to its powerful stimulant properties it may temporarily brace the nervous system, but its prolonged use is dangerous. It should be employed temporarily only to combat great depression of the system.

Untoward Effects.—Care should be exercised in giving strychnine to children, as they are more susceptible to the drug than are adults. The proper beginning dose of strychnine by the mouth for a child of five or six years is not more than $\frac{1}{100}$ grain (0.0006). In some cases of exhausting disease the prolonged use of full doses of strychnine may produce a talkative delirium with great peevishness, and if the drug is continued, this condition may pass into a state of temporary insanity. Brunton asserted that nux vomica may induce malarial chills in those predisposed to them. He also asserted that strychnine acts more powerfully when given by the rectum than by the mouth. This is doubtful.

Administration.—The extract of nux vomica (*Extractum Nucis Vomicæ*, U. S., and *Extractum Nucis Vomicæ Siccum*, B. P.) is given in the dose of $\frac{1}{6}$ to $\frac{1}{4}$ grain (0.01–0.015), $\frac{1}{4}$ to 1 grain (0.015–0.06), B. P.; the fluidextract (*Fluidextractum Nucis Vomicæ*, N. F., *Extractum Nucis Vomicæ Liquidum*, B. P.) is given in the dose of 1 to 5 minims (0.05–0.3); the tincture (*Tinctura Nucis Vomicæ*, U. S. and B. P.) is used in the dose of 5 to 30 minims (0.3–2.0), 5 to 15 minims (0.3–1.0), B. P. *Strychninæ Sulphas* (U. S.), *Strychninæ Nitras* (U. S.) and *Strychninæ Hydrochloridum* (B. P.) are given hypodermically in the dose of $\frac{1}{30}$ to $\frac{1}{20}$ grain (0.002–0.003), and by the mouth in the same amounts. In cases of severe surgical shock as much as $\frac{1}{10}$ grain (0.006) may be used hypodermically. The B. P. recognizes a solution (*Liquor Strychninæ Hydrochloridi*); dose, 2 to 8 minims (0.1–0.5).

Poisoning.—When a poisonous dose of strychnine is taken, it may act either suddenly or gradually. If suddenly, the man or animal may, without premonition, be thrown several feet and become rigid by contraction of the muscles. If onset is gradual, some stiffness at the back of the neck and uneasy startings may precede the general nerve-storm.

The convulsions are tetanic, or, in other words, tonic, and the body is thrown into opisthotonos: that is, resting on the head and heels at each convulsion. Rarely the trunk is twisted sidewise or the flexion of the body is forward (emprosthotonos). The eyes are open and fixed, the corners of the mouth drawn back into *risus sardonicus*, and respiration during a severe convulsion is impossible owing to the respiratory muscles being in a state of tetanic rigidity.

The slightest noise, draught of air, or touch may cause a convulsion or convulsion after convulsion, because the sensory impulse, reaching the spinal cord, causes a spasmodic motor impulse to be sent out to the muscles.

The convulsions are not absolutely continuous, but periods of utter or partial relaxation occur, during which the patient breathes easily. The cramp-like contractions of the muscles are exceedingly painful. The patient either dies of cramp asphyxia—that is, through failure of respiration because his chest muscles are locked in spasm—or, much more rarely, from exhaustion. After death the posture of the body may or may not be typical of the strychnine spasm. Usually it is not typical, although the severe muscular exertion of the attack may result in the early development of marked rigor mortis.

Reichert has shown that it requires five hundred times the ordinary fatal dose of strychnine to cause death in animals if artificial respition is properly maintained. The average fatal dose for an adult is $1\frac{1}{2}$ to $1\frac{3}{4}$ grains (0.1–0.12). Death has occurred from $\frac{1}{2}$ grain (0.03) and recovery after swallowing 19 grains (1.25). Hewlett has recorded a case in which 15 grains (1.0) were swallowed yet recovery ensued.

Treatment of Poisoning.—The attendant should give at once, if no symptoms have appeared, inhalations of nitrite of amyl, and meanwhile employ the stomach-pump, using the nitrite to prevent any convulsive tendencies during the operation. Draughts of water containing tannic acid, as the chemical antidote, are to be administered, and after the stomach is washed out 60 grains (4.0) of bromide of potassium and 20 grains (1.3) of chloral in solution are to be given. These are the physiological antidotes, for the bromide of potassium depresses the sensory tracts of the spinal cord, and the chloral depresses the motor tracts. If the convulsions prevent swallowing, the patient should be chloroformed with care, and the physiological antidotes given by a stomach tube or in starch-water by the rectum, muscular relaxation being maintained by the anesthetic until the drugs are absorbed. Chloretone may also be given in a 20 to 30 grain (1.3–2.0) dose. Ether cannot be used as a relaxant, as it is too irritant and too slow. Nitrite of amyl is a physiological antidote, but it is useless if a complete convulsive attack is present, as it cannot be inhaled if the chest is immovable. Neither can any other relaxant, such as chloroform, be used under these circumstances. These drugs should be gently given between the paroxysms. If relief does not occur, the nitrite of amyl should be injected hypodermically. Cutler and Alton have shown that intraspinal injections of magnesium sulphate are advantageous. (See Magnesium Sulphate.)

While a light touch may produce a spasm, it is said that a firm, hard grasp of the limb often relieves the pain of the cramp. Sensation and consciousness are preserved in strychnine poisoning unless the asphyxia obtunds them.

Differential Diagnosis.—The convulsions of strychnine poisoning do not resemble those of epilepsy, because they are distinctly tonic and never clonic. From tetanus, strychnine poisoning is to be differentiated by the fact that in tetanus the locking of the jaws comes first, while in strychnine poisoning it comes last. The convulsions of tetanus rarely, if ever, completely relax, while those of strychnine do have periods of relaxation. There is a different history in each case—in one perhaps of an injury, as of a nail run into the foot; in the other, of a dose of poison having been swallowed.

The differential diagnosis of strychnine poisoning from hysterical convulsions is more difficult. The convulsions are rarely so persistently tonic in hysteria, and the peculiar expression of the hysterical face is often seen in such cases. The history of the patient, if obtainable, will throw much light on the case and aid very materially in the differentiation of the two conditions, while the peculiar variations in cutaneous sensibility, such as areas of hyperesthesia and anesthesia, which are so characteristic of hysteria, may render the diagnosis possible.

As the treatment of all these states is virtually identical, the employment of the measures just suggested may be resorted to in each instance, and the diagnosis made afterward.

OPIUM.

Opium (U. S. and B. P.) is the juice or milky exudation appearing on the surface of the unripe capsules of white poppy, or *Papaver Somniferum*, when incised.

Good opium, according to the U. S. P., should contain at least 9.5 per cent of anhydrous morphine.

The chemical composition of this drug is very complex, no less than seventeen alkaloids having been obtained from it, the most important of which are morphine, codeine, narcotine, thebaine, narceine, papaverine, pseudomorphine, and laudanine. It also contains meconic acid and meconine.

Physiological Action.—The action of opium upon man and the lower animals varies with the degree of intelligence or cerebral development. It quiets the brain and excites the spinal cord.

NERVOUS SYSTEM.—The dominant action of opium upon man is to produce nervous sedation in small doses and sleep when given in larger amounts. Sometimes, however, in persons who are accustomed to its use, it produces a state of restless insomnia or quiet, wakeful apathy.

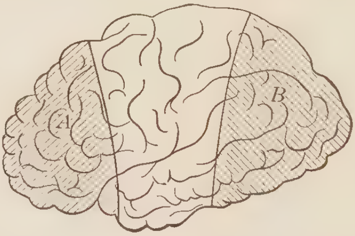

FIG. 60.—*A*, opium produces sleep by depressing the intellectual centers of the brain, and *B*, relieves pain by depressing the perceptive centers in the brain.

CIRCULATION.—Small therapeutic doses of opium have no effect upon the circulation, but large ones primarily slow the pulse, increase its force, and slightly raise arterial pressure.

The slowing of the pulse depends upon stimulation of the pneumogastric nerves peripherally and centrically; the increase in pulse-force results from the stimulation of the heart muscle; the rise of pressure is due chiefly to the increased heart action, but all of these effects are mild as compared to those of digitalis. (See Therapeutics.)

After poisonous doses the pulse becomes rapid and feeble, due to depression of the vasomotor center and the heart, and the gradually increasing asphyxia.

Respiration.—In very minute doses opium is a feeble stimulant, or at least not a depressant, to the function of respiration. In overdose it is one of the most powerful paralyzants of the respiratory centers in the medulla oblongata, causing death by this action.

Temperature.—The bodily temperature is raised slightly by full doses and lowered by poisonous amounts of opium.

Tissue-waste.—Opium acts as a preventive to tissue-waste, decreasing the elimination of urea and other results of nitrogenous breakdown.

Elimination.—If given in excess, the drug escapes from the body as morphine, by way of the intestine and kidneys, but most of it is destroyed by oxidation in the liver and tissues. Experiments made by Alt and Tauber show that morphine is largely eliminated by the stomach, and that if this viscus is frequently washed out during a case of poisoning, recovery is much aided, as by this means resorption is prevented.

Pupils.—The myosis caused by morphine is often ascribed to depression of the dilator portion of the pupillary center situated in the medulla, but the existence of such a center is purely hypothetical, and it is probable that the older teaching, to the effect that the myosis is due to centric oculomotor stimulation, is correct.

Stomach, Intestines, and Secretion.—Opium depresses the motor activity of the stomach and intestines and produces constipation. It does this by stimulating the splanchnic inhibitory fibers of the intestine and thereby preventing peristalsis. In very large doses it increases peristalsis by paralyzing these fibers.

Opium checks every secretion in the body except that of the skin.

Acute Poisoning.—When opium is taken by man in overdose, it causes drowsiness, deep sleep, full breathing, a slow, full pulse, a warm, dry skin, contracted pupils, and pleasant—or, more commonly in the Anglo-Saxon race, disagreeable—dreams or no dreams at all. Preceding this period there may be a brief one during which the individual feels self-satisfied and contented. The duration of this agreeable sensation lasts only a short time, and if the dose is large does not occur or is evanescent. It has been called the first stage, while the more marked symptoms just described have been grouped into a so-called second stage.

During the sleep of the second stage the patient may be roused by shouting in his ear or by violent shaking, but sinks into slumber at once when not disturbed.

Many of the symptoms resemble those of congestion of the brain. The face is suffused and reddened, and may be finally distinctly cyanotic. The breathing may be puffing and stertorous. When the patient is awakened, he breathes more rapidly, and for this reason the duskiness of the face disappears and the normal hue returns. Death never occurs in the second stage of opium poisoning from the poison alone, but if a complicating disease is present death may take place at this time.

The third or fatal stage emerges from the second by a process so gradual that no abrupt line of separation can be noted. The face becomes at first more cyanotic, then pale and livid; the respirations, which have been 8 to 10 to the minute, are now only 4 to 5, and finally such prolonged pauses occur that all hope of another respiration is lost by the attendant. While the slow breathing is at first deep, it soon becomes shallow, and muscular relaxation is present to the greatest degree. The skin, previously dry, is wet with the sweat of death, the patient is so deeply narcotized that nothing can arouse him, and he dies from respiratory failure, although the heart may cease almost simultaneously from the asphyxia. The pupils do not dilate in the third stage, except in the relaxation of death.

TREATMENT OF ACUTE POISONING.—After employing the usual methods resorted to for the purpose of emptying the stomach, and after giving permanganate of potassium or tannic acid, preferably the former, as the chemical antidote, the patient should receive by the rectum one or more cups of black coffee, warm and concentrated. The heat in the liquid is useful in maintaining bodily temperature, and the caffeine stimulates the respiratory center and keeps the patient awake. Caffeine, hypodermically, should be used even before any symptoms come on, in order to prevent their onset if possible. If strychnine is at hand and the respirations are becoming very slow, $\frac{1}{30}$ to $\frac{1}{10}$ grain (0.002 0.006) should be given hypodermically. Strychnine is much better than atropine as an antidote to opium, and should be given hypodermically in full dose, repeated frequently enough to keep the nervous system of the patient active and respiration intact. The pupil is no guide as to the action of atropine in opium poisoning, as the influence of these two drugs (opium and atropine) on the eye is not directly antagonistic. Large doses of atropine are contraindicated, because they depress the respiratory center.

Ammonia as a cardiac and respiratory stimulant may be resorted to.

In the third stage heat should be applied to the trunk and extremities.

Much emphasis has been placed on keeping the patient awake, and it has been thought that the cause of death was the deep sleep. This is not so. The man must be kept awake in order that he will supplement the efforts of his depressed respiratory centers by voluntary breathing. If he sleeps, he forgets to breathe, and sleep means death for this reason, and not because sleep in itself produces death.

Besides the use of hot strong coffee, the patient may be kept awake by lashing him with switches or by walking him up and down between two attendants. Both of these measures are reprehensible if anything better can be done—the first method because it covers the patient with cuts and bruises, the second because it may aid in the production of death by exhaustion. If an ordinary medical faradic battery is at hand, the full force of the current may be allowed to come in contact with the skin from two small poles wet with salt water, or, better still, the dry or wire electric brush should be swept over the body while the negative pole is held in the hand of the patient or pressed against his skin. This causes the most exquisite pain in the normal individual, but if the brush is kept moving will not cause bruises or discoloration. (See Asphyxia.) Artificial respiration may be resorted to.

As pointed out when discussing the elimination of opium, the drug is eliminated into the stomach from the bloodvessels and then reabsorbed. Frequent washing out of the stomach is therefore advisable in cases of poisoning.

Chronic Poisoning.—Morphine or opium when taken constantly generates a habit. The person—or morphine-habitué, as he is sometimes called—depends for a comfortable existence on the drug, and day by day increases the dose until the most extraordinary amounts are taken by the stomach or by means of the hypodermic needle. Thus Coleridge, the author of the "Rime of the Ancient Mariner" is said, by his brother-in-law, Southey, to have taken as much as 2 quarts of laudanum a week. It is interesting to note, as illustrated by the case of Coleridge, that while the opium habit causes moral decay, it has little effect in causing physical decay for this poet began the habit at twenty-four years of age and lived to sixty-two although he also abused alcohol, but all his good work was done by the time he was thirty and little of value later.

This ability to take large doses depends upon an increased ability on the part of the body to oxidize the poison. A full dose given to an ordinary person results in the escape by the bowels of a large percentage of it, but if gradually increasing doses are given, no trace of even large doses are obtainable in the stools or urine. If the drug is withheld from the morphine habitué, a train of symptoms typifying depression or exhaustion ensues. The pulse is scarcely to be felt, horrible mental depression and melancholia come on, the miserable man or woman wrings his or her hands, and begs, screams, howls, or yells for morphine, only to break down and cry on being refused the customary dose. Diarrhea of a serous type and most violent in character, with cramps in the muscles, may assert itself, and must be controlled by astringents and camphor, and an active line of treatment, as far as possible free from opium. (See Diarrhea.)

A characteristic symptom of chronic opium-eating is the development of the most clever lying in previously truthful persons. In the same breath that the patient begs the physician to cure him, he will lie to obtain the drug in a surreptitious manner, and may even have the drug in his mouth at the moment he speaks. It will often be found hidden in the seams of the clothing, and the nurse must be absolutely reliable, above bribery, and forever on the watch lest the drug be obtained by smuggling. Any sudden improvement on the part of the patient should be placed to the credit of more morphine, not to professional skill.

The well-known fact that certain races of mankind are affected by some drugs in quite a different manner from that exerted upon the white race finds an interesting confirmation in the opinion expressed by physicians and government officials, who have investigated the subject in India and China, that a large number of Orientals use opium in moderation for years without deleterious effects. They remain well nourished, are able to perform labor requiring severe physical exertion, and the death-rate among them is not higher than among other classes of people.

Sometimes paregoric is taken in excess, and the writer has seen and treated a case in which over a pint of paregoric was taken every day.

When a mother is an opium-eater, the new-born child often suffers from collapse on the second or third day after birth, owing to the lack of its customary dose of opium.

It is a noteworthy fact that there are cases on record in which as much as 20 grains morphine a day have been taken for thirty years without great mental impairment but efficiency is more or less diminished always.

TREATMENT.—The best way to decrease the use of the drug is to "taper off" the daily dose, and to decrease by a sixth or a fourth the total customary amount in each twenty-four hours. The sudden complete withdrawal of the drug is an unnecessarily severe measure, and its withdrawal in a slower manner than that named is simply prolonging the treatment beyond reasonable limits.

It is essential at the beginning of the withdrawal that the liver and bowels be thoroughly unloaded by 10 grains of blue mass and 10 to 20 grains of compound extract of colocynth.

A very valuable means of treatment is the use of very full doses of hyoscine hypodermically. If this plan is followed, the morphine may be sometimes withdrawn at once. (See Hyoscine.) If the circulation flags, digitalis and strychnine may be given and the remaining symptoms treated as common-sense indicates. Cocaine has been unwisely used to tide over the crisis after the withdrawal of the morphine, and too frequently the patient passes from opium to the cocaine, and finally to the alcohol habit, all of which are equally bad.

Therapeutics.—Opium is used for the relief of five great conditions, which will be spoken of *seriatim*, the minor uses of the drug being considered afterward. These are pain, insomnia, inflammation and irritation, oversecretion and systemic strain.

PAIN.—Opium is the best remedy that we possess for the relief of all forms of *pain*, except in those instances when *neuralgia* is present, when antipyrine and its fellow compounds exceed it in medicinal value because they have no marked after-effects. It is to be remembered, however, that no drug has yet been discovered which equals its pain-relieving power in this or any other painful affection. In the treatment of *renal* and *hepatic colic* associated with spasm, and in *dysmenorrhea*, belladonna and opium, given together, will relieve the spasm and pain, and yet so counteract each other elsewhere in the body as to be devoid of marked effect upon other organs. Usually in these severely painful affections it is best to give morphine and atropine hypodermically, but it is to be borne in mind that, as dysmenorrhea is usually recurrent, this treatment may induce morphinism. Persons suffering from severe pain will usually bear larger amounts of opium than individuals without pain.

For the relief of *violent pain* physicians of experience usually employ morphine hypodermically as the most rapid and effective means of giving relief. If this is not possible, the morphine should be given by the mouth in a little hot water with or without whisky or brandy added to it; or tincture of opium may be given in the same manner. If neither the hypodermic needle nor the draught can be resorted to, then the drug is best given, in the form of the tincture, by the rectum, being first mixed with warm starch-water. If the pain is chiefly in the pelvic viscera, the rectal administration of the drug is advisable by clyster or by suppository.

When pain is due to *violent sciatica* or to *muscular spasm*, it is best relieved by injecting the morphine directly into the subcutaneous tissues or the muscles of the affected part. In other instances local pain due to superficial inflammation may be relieved by compresses wet with laudanum and lead-water. It is a fact that if morphine sulphate is given in 2 cc. of a 25 per cent solution of magnesium sulphate it is greatly increased in power.

To patients who are prone to frequent attacks of pain opium must be given with caution, as the "opium habit" is easily produced.

Many surgeons give $\frac{1}{8}$ to $\frac{1}{4}$ grain (0.008–0.015) hypodermically before administering ether or chloroform, because less of the latter drugs are needed to cause anesthesia. The custom of using morphine before tonsillectomy is unwise, as it adds to the danger of subsequent pulmonary infection by removing the cough reflex after the patient is returned to bed.

(For the use of morphine and scopolamine for the production of surgical anesthesia, see Scopolamine.)

INSOMNIA.—Opium, while capable of producing sleep in almost every case in which it is given, save in those individuals who by reason of idiosyncrasy are made wakeful by it, is only to be used in those instances where the sleeplessness is due to pain. If constantly used for the relief of insomnia or pain, the opium habit is rapidly contracted, and for this reason the use of this drug should be alternated with chloral, cannabis, and other soporific drugs.

In some cases chloral and morphine, when given in small doses in combination, will so act upon the brain as to produce sleep. Thus, in the following prescription, the dose of both active ingredients is much smaller than would be needed if either was used alone, yet the result sought by their use—namely, sleep—is readily produced:

℞—Morphinæ sulphatis	gr. ij (0.12)
Chlorali hydrati	ʒj (4.0)
Syrupi	f℥j (30.0)
Aquæ destillatæ	f℥ij (60.0).—M.

S.—Dessertspoonful (8.0) at 9 P.M., and, if needed, again at 10 or 11 o'clock.

In the *persistent insomnia of typhoid fever, croupous pneumonia* and all acute diseases in which nervous exhaustion is due to lack of sleep, a hypodermic injection of morphine will sometimes produce most excellent results, but the proper use of cold bathing in typhoid fever is to be preferred for this purpose if it can be employed. (See Cold, Part III.)

INFLAMMATION AND IRRITATION.—Opium seems to possess some influence over inflammation which we cannot explain, and both small and large doses are valuable in inflammation of serous membranes, such as *pleuritis, meningitis,* and *pericarditis.* In peritonitis opium has been thought to be useful, but grave doubts are now entertained as to its value. (See the article on Peritonitis in Part IV.)

Opium allays the nervous excitement and cough following *hemoptysis,* and the intense unrest caused by *itching skin diseases,* as, for example, the *irritation of smallpox.*

Sometimes intense irritation or inflammation produces so great an effect upon unstriped muscular fibers as to cause spasm or paralysis, as in *retention of urine, cystitis,* or the *constipation* following inflammation of the bowels due to the ingestion of irritating foods; under these circumstances the employment of opium is indicated, and is usually very successful. In *irritative coughs* morphine given in syrup of wild-cherry bark does good in the dose of $\frac{1}{12}$ to $\frac{1}{10}$ (0.005–0.006).

In some cases of *irritable cough* due to a tickling sensation in the larynx, much relief can be had by inhaling the steam arising from a cup of boiling water in which has been placed a dram or two of paregoric.

Whenever *cough* is excessive—that is, greater than is necessary to free the lungs of mucus—morphine may be given in small doses. If the lungs contain more rales after its use than before, its use must be stopped, as the increase in the number of rales indicates that cough is necessary to keep the bronchial tubes clear.

In the treatment of *strangury* due to *cystitis,* and in *rectal inflammation,* and after operation on the pelvic organs, suppositories of the strength of $\frac{1}{4}$ to $\frac{1}{2}$ grain (0.015–0.03) of the water extract of opium are useful. In *excessive vomiting* from any cause, except it be from a previous dose of opium or uremia, an enema of tincture of opium 30 minims (2.0) and starch-water 4 ounces (120.0), with 40 grains (2.6) of bromide of sodium, will be found of value. (See Vomiting, Part IV.)

In *acute muscular rheumatism*, and in the incipient stage of a "cold," opium in the form of Dover's powder in the dose of 5 to 10 grains (0.3–0.6) will often produce a cure, particularly if employed in combination with hot drinks and a hot foot-bath. Camphor can often be added to the Dover's powder with advantage. (See Coryza and Rheumatism, Part IV.)

For *sprains* and *bruises* lead-water and laudanum is one of the best applications. (See article on Lead.) If the skin is broken, the laudanum may be used alone to relieve pain, and, by its alcohol, will act as an antiseptic. Opium is also a useful drug in the treatment of internal and external *burns* to relieve the pain and irritation.

Oversecretion.—In *serous diarrhea, diabetes insipidus* and *mellitus*, and in the treatment of oversecretion on the part of all secreting surfaces except the skin, opium may be used.

Opium is said to decrease the amount of urine before decreasing the amount of the sugar in diabetes. However this may be, the employment of opium or morphine or codeine in diabetes is a valuable aid to treatment. When moderate doses fail their size must be rapidly increased, as the effect may be obtained only by ascending amounts, and diabetic patients seem peculiarly immune to the nervous influence of this drug and its alkaloids. Morphine is, therapeutically, more powerful than codeine, but crude opium is more powerful for good in this affection than either. None of them, cure the disease, but so modify it as to make life bearable, for the sugar is decreased in many cases, and the excessive hunger, thirst, and nervous irritability are relieved. Itching of the skin is also allayed in this class of patients by its use. (See Insulin, Part II and article on Diabetes, Part IV.) The sudden withdrawal of opium from a case of diabetes may precipitate diabetic coma.

Opium should not be used to arrest an attack of *mucous diarrhea* until after the mucus which is already present in the bowel has been swept out of the intestinal canal by a dose of castor oil or magnesium sulphate. Minute doses of $\frac{1}{80}$ to $\frac{1}{50}$ grain (0.0008 to 0.0012) of morphine given hypodermically will sometimes check *summer diarrhea* in children at once after all undigested food has been swept out by castor oil. (See article on Diarrhea.)

Morphine rather than opium is used to relieve pain because it does not cause so much constipation, but opium is better to check diarrhea. Paregoric is particularly useful in diarrhea because it contains a volatile oil and camphor.

Systemic Strain.—In prolonged strain upon the system, as in great physical or nervous effort, or more frequently in *old age* to smooth the remaining years of life and decrease worry, opium is useful, but its use in young persons is most dangerous, as it is almost certain to produce the opium habit. In *asthenic fevers* opium is thought to be supportive, but its use is apt to cause so many other conditions, such as constipation, anorexia, or mental depression, that alcohol is much better for this purpose. In advanced *phthisis* it is often justifiable to give sufficient opium to keep the patient free from pain and discomfort for the remaining hours of his life, but care must be taken that the dose does not interfere with the breathing and so hasten death.

In *heart disease,* when there is rupture of compensation, the patient can often breathe easily only when awake, starting up when he falls asleep and gasping for breath. It is stated by some writers that morphine will relieve this state and permit sleep, but that it will not be of service in aortic disease. While this may be partly true, the drug will often give great relief in all forms of *cardiac dyspnea,* and ought always to be tried with caution. Care should be taken that the first dose is small, as in some instances it increases the discomfort. The relief obtained is supposed to be due to cardiac stimulation by the drug, and this is no doubt correct, but the nervous quiet or sleep which is induced probably rests an exhausted heart. The presence of cyanosis and lividity is said to be no contraindication to the hypodermic use of morphine under there circumstances, provided the dose is not unreasonably large, and provided these signs are purely circulatory in origin. If they are due to pulmonary edema or diffuse bronchitis, it is unsafe. Not rarely in the course of pneumonia and typhoid fever a state of *nervous restlessness* with active talkative delirium develops, in which the patient may die from lack of sleep. At such times a hypodermic dose of morphine may be most useful and save life. The drug should be given hypodermically for these purposes in the dose of about $\frac{1}{4}$ grain (0.015).

Morphine has been freely given to patients with *uremic convulsions*. This practice requires caution, and should not be resorted to as a rule. Obstetricians of large experience, however, use morphine in very large doses by the needle to control *puerperal eclampsia.* In many cases of eclampsia acidosis is present. Morphine has been shown to raise the carbon dioxide combining power 15 to 20 per cent and is the only nervous sedative which definitely possesses this power. (See Puerperal Diseases, Part IV.)

Administration.—Studies upon the action of opium and its alkaloids show that it acts in an inhibitory manner upon gastric digestion and absorption, decreasing the amount of hydrochloric acid in the gastric juice. For this reason, unless there is an excess of acid present in the stomach, it is well not to give opium or morphine at meal-time, but some time after.

Opium itself is used in the form of the powder (*Opium Pulveratum,* U. S.), and in granulated form (*Opium Granulatum,* U. S.) in the dose of from $\frac{1}{4}$ to 2 grains (0.015–0.12). Of the watery extract (*Extractum*

Opii, N. F., and *Extractum Opii Siccum,* B. P.) the dose is ¼ to ½ grain (0.015-0.03), ¼ to 1 grain (0.015-0.06), B. P. Of the liquid preparations we have paregoric (*Tinctura Opii Camphorata,* U. S.; *Tinctura Camphoræ Composita,* B. P.), dose 1 dram to 1 tablespoonful (4.0-16.0); B. P. dose is 30 to 60 minims (2.0-4.0); laudanum (*Tinctura Opii,* U. S. and B. P.), dose 5 to 30 minims (0.3-2.0). *Vinum Opii,* sometimes called Sydenham's laudanum, dose 5 to 30 minims (0.3-2.0); and *Acetum Opii,* or black drop, dose 5 to 30 minims (0.3-2.0) are not official.

As all the liquid preparations of opium in the U. S. P. are of 10 per cent strength, except paregoric, which is about 2 grains to the ounce, the dose of all of them except paregoric is identical. This is a fact to be particularly remembered by students.

Under the name of Dover's powder (*Pulvis Ipecacuanhæ et Opii,* U. S.; *Pulvis Ipecacuanhæ Compositus,* B. P.), a powder containing 1 part of powdered opium, 1 part of powdered ipecac, and 8 parts of sugar of milk is largely used. The dose is 5 to 20 grains (0.3-1.3). It is more efficacious if separated into fifths and taken in divided doses. The tincture of ipecac and opium (*Tinctura Ipecacuanhæ et Opii*) is given in the dose of 5 to 30 minims (0.3–2.0).

The preparations of opium official in the B. P., other than those named, are *Extractum Opii Liquidum,* dose 5 to 30 minims (0.3-2.0); *Pulvis Opii Compositus,* composed of opium, pepper, ginger, caraway-fruit, and tragacanth, dose 2 to 10 grains (0.12–0.6); *Tinctura Opii Ammoniata,* dose ½ to 1 dram (2.0-4.0). *Pilula Saponis Composita,* B. P., is really a preparation of opium. It is sometimes necessary to give this drug to patients without their knowledge, and it may be prescribed in this way, the patient not learning from the prescription the nature of the medicine. The dose is 2 to 4 grains (0.12–0.25).

Under the name of pantopon (*Pantopium Hydrochloridum*) a German preparation, a soluble preparation of the combined alkaloids of opium is on the market for use by the mouth or hypodermic needle. It is claimed to be more sedative than morphine. The dose is ⅙ to ¼ grain (0.01–0.015).

Untoward Effects.—When opium is given to some individuals it produces for several hours marked wakefulness followed by sleep, and in many patients causes after its primary influence great nausea, and sometimes vomiting. The mental depression may be simply overwhelming, and the very fact of having to drag out existence is a curse. By far the most effective mode of preventing these very distressing effects of opium or its derivatives is to administer with this drug about $\frac{1}{100}$ grain of nitroglycerin. One of the chief causes, however, of the nausea produced by the use of opium or morphine is the change in the body of morphine into oxy-dimorphine, which is eliminated into the stomach and there reabsorbed, and then induces these secondary effects. It is also a fact that these symptoms can be largely relieved by the use of 20 grains (1.3) of bromide of potassium, which must be taken at the same time as the opiate. After the untoward symptoms come on coffee and stimulants may be used with advantage to overcome them. In some persons the use of opium is followed by itching of the nose or by the development of an erythematous rash which may go on to desquamation.

Children bear opium badly, and some children are very much more susceptible than others to its influence.

One-eighth grain of morphine has been followed by death in an adult when given hypodermically, probably because it entered a vein.

In some persons a single dose of morphine excites obstinate vomiting, due probably to the change of the drug into oxydimorphine or apomorphine.

Codeine.

(See p. 246.)

Morphine.

Morphina, B. P., is the chief alkaloid of opium, but owing to its insolubility is rarely used, being generally given in the form of sulphate.

Sulphate of morphine (*Morphinæ Sulphas*, U. S.) is given in the dose of $\frac{1}{8}$ to $\frac{1}{2}$ grain (0.008–0.03), either by the mouth or hypodermically. Besides the sulphate of morphine we have the hydrochloride (*Morphinæ Hydrochloridum*, U. S. and B. P.), and the tartrate (*Morphinæ Tartras*, B. P.), all given in the dose of $\frac{1}{8}$ to $\frac{1}{2}$ grain (0.008–0.03). *Pulvis Morphinæ Compositus*, or Tully's powder, is given in the dose of 10 grains (0.06). Ten grains contain sulphate of morphine about $\frac{1}{6}$ grain (0.06), camphor 3 grains (0.19), liquorice $3\frac{1}{3}$ grains (0.2), and precipitated calcium carbonate $3\frac{1}{3}$ grains (0.2). It is used to check forming colds and as a nervous sedative. Troches of morphine and ipecac (*Trochisci Morphinæ et Ipecacuanhæ*) are given one or two at a time for *irritation of the pharynx*.

The following additional preparations of morphine are official in the B. P.: *Liquor Morphinæ Hydrochloridi* and *Liquor Morphinæ Tartratis*, dose 10 to 60 minims (0.6–4.0); *Tinctura Chloroformi et Morphinæ Composita*, dose 5 to 15 minims (0.3–1.0); *Suppositoria Morphinæ*, each suppository containing $\frac{1}{4}$ grain (0.015) of morphine; *Trochiscus Morphinæ* and *Trochiscus Morphinæ et Ipecacuanhæ*, each lozenge containing $\frac{1}{36}$ grain (0.002) of morphine, dose 1 to 4. *Liquor Morphinæ Acetatis* is given in 10- to 60-minim (0.6–4.0) doses. *Injectio Morphinæ Hypodermica*, B. P., contains $\frac{1}{2}$ grain (0.03) of the tartrate of morphine in each 22 minims (1.4) of water. Its dose is 1 to 10 minims (0.05–0.6).

Incompatibles.—Morphine is incompatible with potassium permanganate and with tannic or gallic acid or solutions containing them;

with alkalies, such as potassium, sodium, and ammonium salts, but with chloride of ammonium it is not incompatible. With tincture of chloride of iron it forms a deep red color (meconic acid).

ORTHOFORM.

Orthoform, which is the methyl ester of para-aminometaoxybenzoic acid, has been supplanted by "orthoform new," which is metamino-para-oxybenzoic acid and the latter is a colorless, bulky, odorless, and tasteless powder which is quite soluble in hot water. It is used as a local anesthetic and antiseptic dressing for *small wounds* and *burns,* and is said to be non-toxic, but this is an error. It may be applied in powder or ointment. The latter is usually of the strength of 2 drams to 1 ounce of lanolin (8.0–30.0). It may be given by the stomach in cases of *epigastric pain* to determine its source. In cases of *gastric ulcer it may relieve the pain,* but if the pain be due to gall stones it will fail. The dose is 2 to 5 grains (0.12–0.3), in pill or capsule, three times a day on an empty stomach.

OVARIAN EXTRACT.

The ovarian gland, from which the corpus luteum has been removed, in the form of the dried gland substance or in that of an extract made from it, has been used for relief of the nervous and nutritional *disturbances of the menopause,* whether they be the result of age or of operative removal of these bodies. It has been used in *dysmenorrhea,* due to the formation of clots, and in *sexual frigidity.* It is said to be the most efficacious in those instances in which the ovaries have been removed from young women. Some practitioners report excellent results from its use in severe vomiting of pregnancy, using 5 grain (0.3) tablets every three hours or in their place giving 1 cc. of a solution of soluble extract by hypodermic needle. As the use of the ovarian extract in medicinal doses seems to be harmless, it may be given for a long time without danger. The beginning dose should be 5 to 10 grains (0.3–0.65) a day, and this be gradually increased until some effect is produced or it proves useless. The best method of giving it is in compressed tablet or in capsule. A solution representing an extract of ovary is now on the market for intramuscular use. Professional opinion as to its value is much divided. but I have gotten some excellent results from its use. (See also Corpus Luteum.)

Estrogen.—Ovarian extract fails to give relief in some instances probably because it does not represent the activity of the ovary at a suitable cycle of its function. Under the name of Estrogen a preparation representing the hormone found in the ovarian follicle, when given to animals who have been sterilized by removal of the ovaries, causes a return of the function of "heat" or œstrus. Estrogen is used intramuscularly or hypodermically, not intravenously, in the form of a solution the strength of which is 25-rat units. A rat unit is the quantity which will produce œstrus in an ovariectomized rat in ten days.

Estrogen appears in ampoules of 1 cc., one or two of which may be injected every day for a week or repeated after an interval of some days. It is used in cases of *sexual frigidity,* to relieve symptoms of the *menopause,* etc., as is corpus luteum or the ovarian extract just described.

OX–GALL.

Ox-gall (*Extractum Felis Bovis*) is, as its name implies, dried ox bile, derived from the gall-bladder of the common ox (*Bos taurus*). It is used in medicine for the purpose of relieving certain forms of indigestion which result from deficient secretion of bile or which occur in persons who digest fats with difficulty. In full doses it is apt to cause some looseness of the bowels, and it may be given with the object of producing this condition. When it is used, the fact should be remembered that bile prevents the gastric juice from acting upon proteid or albuminous substances, shrivelling them up, and in addition so alters the gastric liquids as to decrease their digestive power. We know, therefore, that this drug must be administered some hours after meals, as a rule, or, in other words, when gastric digestion is ended and intestinal activity is beginning. The dose of ox-gall is 5 to 15 grains (0.3–1.0). Purified ox-gall; *Fel Bovinum Purificatum*, B. P.) is given in the same dose as U. S. P. preparation.

OXYGEN.

The gas oxygen is now widely used in medical and surgical practice in two ways, as follows: By inhalation of the gas itself from a cylinder in which it is compressed until many gallons occupy a very small space. Commercial oxygen is cheaper than so-called medicinal oxygen and can be safely used except in connection with anesthetics.

It is important to bear in mind that oxygen is not a respiratory stimulant. If administered too freely it diminishes the activity of the respiratory center. If because of disease or toxemia it is depressed, carbon dioxide is to be given to cause the respiratory center to put out more effort (see Carbon Dioxide), but in many instances where cyanosis is present due to capillary paralysis neither oxygen nor CO_2 can be of service as, for example, in the cyanosis of influenza, in which disease there is often in addition hemolysis which interferes with the carrying of O to the tissues and the return of CO_2 to the lungs.

The use of a mask to make the inhalation effective is usually intolerable and the mere escape of gas under the nose is entirely useless. A good plan is to slip a lubricated catheter preceded by an application of a solution containing procaine and ephedrin 3 per cent each, through the nasal passages to the soft palate and to connect this with the wash-bottle through which the gas passes as it leaves the tank. The catheter is readily kept in place by an adhesive strip on the skin of the face. There is little use in giving it except for a period of an hour and if really needed it should be employed continuously. Davies has shown that about 2 liters of gas per minute are needed to be of real benefit and this means a flow of bubbles through the wash-bottle far faster than is the common practice. By this means as much as 25 to 30 per cent of oxygen may be given.

Several forms of apparatus have been devised for this use of oxygen. My experience is that most of them are theoretically good, but practically useless, because the patient suffers from a sensation of being in a coop which he will not tolerate when dyspneic and because so much gas escapes at the margins of the head covering that the patient gets little of it.

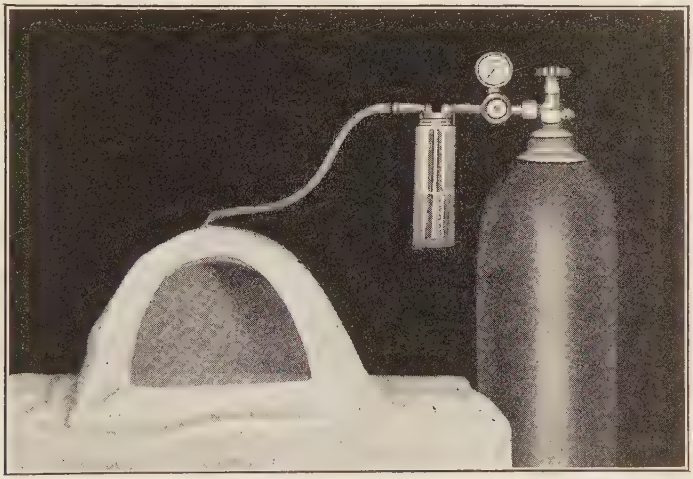

Fig. 61.—An efficient method of administering oxygen in pneumonia. The 5 sight feed holes calibrated to feed 1 liter per minute for each hole, thus maintaining a uniform flow regulated from 1 to 5 liters. Tent frame of metal, tent cover and celluloid window are easily disassembled and reassembled for sterilization.

Some of the forms of apparatus require the use of an electric motor and chemical reagents. One of the best is the Guedel oxygen meter with small tent (Fig. 61). By this means a cumbersome apparatus is avoided and an adequate measure of oxygen gas per minute is provided. If commercial oxygen is employed the cost of the gas is less than $2.00 for eleven hours at 4 liters of gas per minute.

Lack of oxygen not only causes dyspnea and exhaustion but it results in damage to vital tissues.

Inhalations of oxygen are useful in the second and third stages of *pneumonia* where the patient seems to be suffering from deficient aëration of the blood and associated heart distention. Indeed it should not be withheld until cyanosis is marked but used to prevent it. In cases in which toxemia is marked with little area of the lung involved it cannot be expected to do good. When used it should be given continuously. (See Pneumonia, Part IV.) It is also useful when a patient has dyspnea in the ruptured compensation of cardiac disease. (See Heart Disease, Part IV.) It is also of value in advanced *bronchitis*, particularly that of old persons, and for the resuscitation of individuals asphyxiated by coal-gas if used with carbon dioxide. Much more recently Henderson has shown that life may be often saved in carbon monoxide poisoning by adding 5 per cent CO_2 to the oxygen gas. (See Carbon Dioxide.) The basis for this use of CO_2 rests upon the fact that this gas is a stimulant to the respiratory center. When the danger of monoxide poisoning is ever present an apparatus with this combination should always be ready for use. In *advanced pulmonary tuberculosis* oxygen will allay dyspnea and oppression. Oxygen inhalations are also of service in the treatment of *anemia* in all its forms and give relief even in *pernicious anemia* and in *leukemia* if there is dyspnea. Often a mixture of oxygen gas, 60 parts and nitrous oxide gas, 40 parts, is used as a stimulant inhalation and nervous sedative.

The clinical results which have so far been obtained from the administration of ether and chloroform vapor when combined with oxygen gas seem to prove beyond all doubt that the oxygen decreases the danger of the anesthetic and to a large extent obviates the difficulties which attend the administration of these drugs, and most of the untoward effects which result from their use. Thus, when oxygen is given with ether, vomiting is less frequently met with, excessive pallor is rarely seen, and postoperative depression seems to be largely avoided.

It has been the custom of some physicians and surgeons who have employed oxygen gas in combination with ether or chloroform, to place the anesthetic in a wash-bottle and then to allow the oxygen gas to pass through it in such a way that the patient received in the inhaler a mixture of anesthetic vapor and oxygen, the mixture resulting from the passage of the oxygen gas through the liquid anesthetic in the bottle. An evident disadvantage of this arrangement is that the quantity of anesthetic which is volatilized can only be in direct proportion to the volume of oxygen gas which is forced through the wash-bottle, and therefore with every increase in the quantity of vapor which the patient receives he must also receive an increased quantity of oxygen. It has been claimed too, by those who have employed the ether and oxygen combination most frequently, that in a certain proportion of cases a greater length of time is required for the anesthetizing of the patient, and that in some cases it seems almost impossible to get the patient under the direct influence of the drug. This difficulty lies in the fact that as soon as a large quantity of oxygen gas is used to convey much of the anesthetic vapor to the lungs, the patient rapidly passes into a condition which is called by physiologists apnea. The respiratory center is no longer irritated by the normal proportion of carbonic acid in the blood, and therefore sends out feeble respiratory impulses; and as the patient does not breath so rapidly or so deeply as before, the result is that very small quantities of the anesthetic are taken into the body.

The tube which leads off from the oxygen tank should be directly connected with the inhaler and the gas given as desired.

The writer cannot condemn too strongly the method of employing chloroform vapor and oxygen by passing the oxygen directly through the chloroform without the free administration of air in addition for, after all, air is what we are intended to breathe, and not oxygen gas alone, although it may be advantageous at times to add an increased quantity of oxygen to the air.

When oxygen is used with nitrous oxide it must be medicinal oxygen, because commercial oxygen contains about 4 per cent of water and freezing at the valve takes place.

(For the directions for using oxygen with ether and nitrous oxide as anesthetics see the articles on Ether and Nitrous Oxide.)

PANCREATIN AND PANCREATIC EXTRACTS.

Under these names a number of firms now sell an extract from the pancreatic gland or juice of the hog or ox and the U. S. P. recognizes such a product under the name of *Pancreatinum*. Pancreatinum should convert twenty-five times its own weight of starch into substances soluble in water (U. S. P.). It contains, or should contain, the four pancreatic ferments—trypsin, which digests proteins (meat, eggs, etc.); steapsin, which splits up and emulsifies the fats; amylopsin, which has diastatic power (that is, converts starch into sugar), and finally a milk-curdling ferment.

(For the use of pancreatin in artificial digestion see the article on Peptonized Foods in Part III).

Pancreatin, as prepared for the market, is a dry powder, given in the dose of 2 to 20 grains (0.12–1.3) after meals or during them.

Pancreatin should usually be prescribed with bicarbonate of sodium to aid it in its digestive action. It is indicated in all cases of *lienteric diarrhea* and in many cases of deficient digestion.

Some doubt has been cast upon the usefulness of the employment of pancreatin in foods unless this ferment is allowed to act upon the aliment before it is swallowed by the patient, on the ground that pancreatin is destroyed and rendered inert in the presence of the acid which it meets in the stomach. This objection is not a valid one, because food remains in the stomach for from fifteen minutes to one-half hour, before enough gastric juice is secreted to interfere with the pancreatic action. It is during this preliminary period that the work of the pancreatin is accomplished.

Pancreatized or peptonized foods should not be employed unless really needed, nor continued for any length of time, as digestion is finally impaired by torpor of the glands arising from disuse.

The B. P. recognizes a solution (*Liquor Pancreatis*); dose 1 to 2 drams (4.0–8.0).

The dose of pancreatin is from 2 to 20 grains (0.12–1.3).

PARALDEHYDE.

Paraldehydum, U. S. and B. P., is a form of aldehyde used as a *soporific* and *nervous sedative* and may be given to relieve *spasmodic asthma,* in the dose of 60 minims (4.0). It is also useful in *epilepsy.* (See below.) It is a clear colorless liquid with an ethereal odor and a burning, followed by a cool taste. It should be kept in dark, well-stoppered bottles in a cool place. Paraldehyde is readily soluble in alcohol, moderately so in cold water, less so in hot water. It possesses the great disadvantages of being necessarily given in large dose and of having a disagreeable taste and odor. It is also prone to disorder the stomach. Paraldehyde kills by respiratory failure when taken in overdose, but is not so depressant to the heart as is chloral, and it is not to be classed as a dangerous drug. Clouster records a case which received 2 ounces (60.0) by accident without grave results. The drug soon loses its power as a soporific. As it is speedily absorbed and acts promptly, it ought to be taken after the patient is in bed. The dose is 20 minims to 1 dram (1.3–4.0) in capsules, or with equal parts of simple elixir, or it may be used, after the formula of Yvon, as follows:

℞—Paraldehydi	ʒijss (10.0)
Alcoholis (90 per cent.)	f℥iss (45.0)
Tincturæ vanillæ	fʒss (2.0)
Aquæ destillatæ	f℥j (30.0)
Syrupi . . . . q. s. ad	f℥iv (120.0).—M.

S.—A dessertspoonful (8.0) every half-hour until sleep is obtained.

Another formula is as follows:

℞—Paraldehydi	ʒij (8.0)
Syrupi	f℥j (30.0)
Fluidextracti glycyrrhizæ	fʒij (8.0)
Aquæ destillatæ . . . . q. s. ad	f℥iv (120.0).—M.

S.—One-half to 1 ounce (15.0–30.0) as a dose.

Much larger doses are often used in nervous and alcoholic cases. Thus as much as 1 ounce (30.0) may be given in an equal amount of olive oil by the rectum, with excellent results in *status epilepticus* and to induce an anesthetic sleep, if the patient is a fully developed adult, when anesthetics by inhalations are contraindicated.

PARATHYROID GLAND.

Notwithstanding the fact that Collip has succeeded in isolating from the parathyroid glands their active principle, or hormone, and has established that this substance has a very great influence over what may be called calcium metabolism, its influence over other nutritional processes is as yet only partly disclosed. That this active principle when administered to animals suffering from the effects of parathyroidectomy has an extraordinary influence in restoring them to the normal, if they are kept under its influence, is certain and these effects have been proved to occur in man when the parathyroid function has become impaired. It apparently depends for its curative properties upon its ability to raise the calcium content of the blood serum to normal, said content being lessened in the condition referred to. The chief symptom of lowered calcium content is *tetany* in which state a lowered calcium content is not always, but nearly always, present. It is not proved that all cases of tetany suffer from this state, as, for example, gastric tetany. Indeed there appear to be other factors needing further study before the exact sphere of usefulness of parathyroid extract is determined. The point for the physician to bear in mind is that parathyroid extract is a potent agent having a narrow margin of safety and it is a question how freely it should be used unless it is possible to determine what the blood calcium is both before and during its use. Thus the normal blood calcium is about 10 milligrams per 100 cc., but if by the use of the extract this content is raised to 12 milligrams there is danger of causing hypercalcemia and if 15 milligrams are exceeded a definitely dangerous zone is reached. If 20 milligrams is reached there is a sharp rise in blood non-protein-nitrogen and in urea, with a decrease of chlorides and an increased viscosity. Complete suppression of urine may take place and death occur. It is evident not only that one should be sure of the calcium level of the blood when using this substance but that it is essential that the product and dose be standardized. Collip has succeeded in doing this so that a unit of the extract is the one-hundredth of the amount which will produce an increase of 5 milligrams of calcium in the blood serum of a healthy dog weighing 20 kilos in the course of fifteen hours. The dose for an adult, hypodermically, is probably 10 units at intervals of twelve hours until symptoms moderate or the blood analysis shows a calcium uplift equaling 10 or 11 milligrams, the normal level, but it is evident that while the extract has been standardized the dose has not and that one must feel his way unless blood analysis is constant. Thus McCann states that 10 units given at fairly long intervals is the starting dose for an adult, but Hoag and Rivkin states that a child of 8 kilos or about 18 pounds may receive 25 units every six hours with advantage. When a normal calcium level is reached it can usually be maintained by about one-sixth the initial dose.

I have seen the extract used freely in human beings with apparently little fear of dire results and without such occurrence, but it is apparent that except in urgent cases one must feel his way as to dosage. It is also evident from experience that the best results will follow the simultaneous use of calcium lactate by the stomach, or needle, but not intravenously since calcium has a powerful cardiac effect. The use of calcium probably permits smaller and safer doses of parathyroid extract. Also it would appear that full doses of the hormone with the free use of calcium may readily induce hypercalcemia.

As with all the endocrine glands, the parathyroids have been given by the stomach for a host of maladies and escape from evil effects has probably been due to the fact that a large part of the dose when given by the stomach is destroyed by that viscus. If the physician wishes to use the gland itself, the dose by the stomach is $\frac{1}{10}$ grain of the desiccated gland equal to 8 grains of the fresh gland.

To sum up it may be said that parathyroid gland may be given not only for ordinary tetany, which is relatively rarely met with, but in any convulsive state, as eclampsia or the convulsions of severe pertussis, provided blood analysis shows a low-calcium content of the serum. Aub and others have shown that in *chronic lead poisoning* parathyroid gland causes an increase in lead elimination from the bones side by side with calcium derived from this source. In acute or subacute poisoning it is contraindicated because when the body is trying to imprison lead in the bones it tends to set it free. Therefore, its field of usefulness is in chronic cases without acute symptoms. As chronic lead poisoning often induces chronic contracted kidney, which is characterized by high non-protein-nitrogen, and as parathyroid gland tends to raise this also, its use, unless watched carefully, is probably unwise. Furthermore, it seems to increase the output of lead for only a short time. (See Lead.)

Under the name of para-thor-mone the active principle of the parathyroids is marketed in 5 cc. vials containing 100 units or 20 units in each cc. It is also on the market as Paroidin in 5 cc. vials.

Cantarow, Gordon, and others, have shown that this product distinctly diminishes the coagulation time of the blood in jaundice and even seems to be of value in patients suffering from internal hemorrhage as in pulmonary tuberculosis.

PEPO.

Pepo (*Cucurbita pepo*), U. S., pumpkin-seed, the seed of the ordinary domestic pumpkin, is a useful and efficient vermifuge for the *tapeworm*. The seeds are not only efficient, but are harmless to the host of the worm. The outer coverings of the seeds should be removed, and the remaining part rubbed up into an emulsion with water or into an electuary with sugar, the dose of the seed being 2 ounces (60.0). This mass should be taken on an empty stomach, and followed in from one to two hours by an active purge.

PEPPERMINT.

Mentha Piperita, U. S., is official in the form of the dried leaves and tops of *Mentha piperita.* It has an aromatic odor and taste and contains an oil. Locally applied, the oil acts as an irritant and local anesthetic. From this oil is obtained menthol, a camphoraceous substance of a hot, burning taste, possessing marked power as a local anesthetic. (See Menthol, below.)

Therapeutics.—Peppermint is used very largely as a domestic remedy for *flatulence* and *infantile colic.* Sometimes the oil is added to purgative pills to prevent *griping,* and it may be employed to disguise the taste of any medicines which are disagreeable to take. In this respect it is used as are all the volatile oils. In the *colic* of children of six months to a year of age, when it is unusually severe and associated with nervous symptoms, the following will be found of value:

℞—Chlorali hydrati	gr. xvj (1.0)
Potassii bromidi	gr. xxxij (2.0)
Aquæ menthæ piperitæ	f℥ij (60.0).—M

S.—Teaspoonful (4.0) in a little warm water every four hours.

When used in the treatment of *neuralgia,* oil of peppermint should be placed on a piece of linen or muslin rag and applied over the affected spot. Care must be taken that it does not blister the skin. If, after its removal, the burning is too severe to be borne, a little cosmoline or olive oil should be applied. Oil of peppermint is sometimes placed on cotton and inserted into dental cavities for *toothache.*

It is to be remembered that the more menthol is present in the oil the more active will it be as an anesthetic, and that the Chinese oil contains more menthol than the American oil.

Administration.—Peppermint is used in the form of the oil (*Oleum Menthæ Piperitæ,* U. S. and B. P.), dose 1 to 4 minims (0.06–0.25); the spirit (*Spiritus Menthæ Piperitæ,* U. S. and B. P.), dose 10 to 30 minims (0.6–2.0); the water (*Aqua Menthæ Piperitæ,* U. S. and B. P.), dose 1 to 2 drams (4.0–8.0); and, finally, as the troches (*Trochisci Menthæ Piperitæ*), to be held in the mouth in indefinite number.

Menthol.

Menthol, U. S. and B. P., or mint stearopten, or, as it is called, mint camphor, is derived chiefly from the essential oil of peppermint. Upon it rests much, if not all, of the therapeutic activity of peppermint. Menthol is slightly soluble in water, very soluble in alcohol, ether and in oils.

Menthol has been used in the *vomiting of pregnancy* with great advantage in hourly doses of a teaspoonful of the following:

℞—Mentholis	gr. xv (1.0)
Spiritus frumenti	fʒvj (24.0)
Syrupi	f℥j (30.0)

Menthol has also been used as a carminative and in *gastralgia* in the dose of from 1 to 2 grains (0.06–0.12) three times a day in pill or in alcoholic solution. It is contraindicated in acute inflammation of the gastric mucous membrane. As menthol exercises a local anesthetic effect on the skin as well as on mucous membranes, it is used externally over the course of *neuralgic nerves* and for *migraine* by means of menthol pencils.

Menthol when applied to the mucous membrane of the throat or nose causes a contraction of the local bloodvessels, which is not followed by the excessive dilatation produced by cocaine. In *acute coryza* its local application to the mucous membrane by a spray or dropper is often a source of great relief in a solution of about 1 grain (0.06) to 1 ounce (30.0) of water, or 3 grains (0.2) of menthol in 1 ounce (16.0) of liquid petrolatum. (See Coryza, Part IV.)

Another very useful method of applying menthol is by means of a simple inhaler consisting of a small glass tube of about ¼ inch in diameter and 2½ inches in length. Both ends are closed by a piece of gauze and two perforated corks, the menthol being placed in the tube. The air is now drawn through this tube, and, being heavily loaded with the fumes, clears the nares and relieves the stuffiness. It is not to be only smelled, but also inhaled. Care should be taken that the crystals are not allowed to enter the nostrils, as they are almost cauterant in power. Sometimes where great excoriation of the alæ of the nose exists, the too persistent use of the menthol may produce small herpetic spots about the nostrils. When menthol is inhaled for a long time or swallowed in any quantity it is apt to produce severe congestive headache.

Still another method is by the use of a nebulizer. (See article on Inhalations, Part III.) The following mixture is placed in the glass jar, and air being driven through the tube a vapor of the drug is given off which is a valuable sedative to the entire respiratory tract.

℞—Chloretone	gr. ij (0.12)
Mentholis	gr. xx (1.3)
Camphoræ	gr. xx (1.3)
Olei cinnamomi	♏ij (0.1)
Petrolati liquidi	f℥j (30.0).—M.

S.—Use in a vaporizer every three hours for a period of about ten minutes. Often it is well to use this formula in half strength.

Sometimes menthol in 10 per cent alcoholic solution is dropped on the cone with which ether is given, to diminish the irritation caused by that drug when it is inhaled.

Menthol vapor is also useful in *spasmodic croup*. (See Part IV.) *Emplastrum Menthol*, B. P., is used as a mild local irritant and anesthetic.

PEPSIN.

Pepsinum, U. S. and B. P., is the digestive ferment of the gastric juice. That sold in the shops is generally derived from the pig, and is prepared by manufacturers in many ways. Much of the pepsin of the market contains more peptone than pepsin, and much mucus and albumin. Used with hydrochloric acid in weak solution, pepsin carries out the digestive action of the stomach. Pepsin containing peptone has the peculiar musty smell of peptone, and if the peptone is in excess will absorb moisture and become sticky on exposure to the air.

According to the U. S. P. official pepsin must have the power to digest three thousand times its weight of albumin.

Therapeutics.—Pepsin is a much over-rated remedy for *indigestion*, which in many cases is due to hepatic disorder or to actual disease of the stomach which it cannot relieve. Pancreatin will nearly always be found more serviceable, and should be given either during or one or two hours after meals. Pepsin should be used immediately after the food is taken or with it. Hydrochloric acid should always be given with pepsin to aid its action, and because it converts the pepsinogen in the gastric tubules into pepsin. *Liquor Pepsini* is given in the dose of 2 drams (8.0). Pure pepsin should be given in 5- to 15-grain (0.3–1.0) doses. A glycerite (*Glycerinum Pepsinum*) is official in the B. P.

Very useful and readily taken liquid preparations are pepsin essence and cordial, which are given in the dose of 1 to 2 drams (4.0–8.0) after meals. A nutritious article of diet can be made by adding one teaspoonful of either of these liquids to ½ pint of warm milk, and allowing it to cool, thereby forming "curds and whey" through the action of the milk-curdling ferment. (See Part III.)

PETROLATUM.

Under the name of *Petrolatum*, U. S., or soft petrolatum, or *Unguentum Petrolei*, is sold a semi-solid substance derived from certain kinds of petroleum, and sometimes called cosmoline or vaseline.

Owing to its soothing powers and non-rancidity, it is used as an emollient dressing in sores and skin affections. It has no value except as a protective. It is not absorbed, although assertions to the contrary have been made.

Petrolatum is a useful ointment base for medicaments for the skin. Under the name of fluid or liquid petrolatum (*Petrolatum Liquidum*, U. S.) a fluid form is sold, which is much used in the form of a spray in the treatment of *rhinitis* and after irritant applications to the nasal cavities. Liquid petrolatum in its heavy form is useful as a laxative in the dose of 1 to 2 tablespoonfuls (15.0-30.0) at night, or a tablespoonful (15.0) three times a day. The constant use of liquid petrolatum sometimes induces pruritus ani.

Petrolatum Album (U. S.), or white petrolatum, is a purer product, being devoid of coloring matters.

PHENOBARBITAL.

Phenobarbitalum (U. S.) or Luminal or Phenyl-ethyl-barbituric acid differs from barbital in that one ethyl group has been supplanted by one phenyl group. It decreases respiratory frequency but is said to increase the depth of each respiration. It is eliminated by the kidneys in large part unchanged. In poisonous dose it kills by respiratory failure, but recovery after taking 60 grains is reported. Its chief use is to produce sleep in *nervous insomnia* and act as a sedative in marked nervous excitement. It is also very valuable in *epilepsy*. (See Part IV.) The dose is from 1 to 2 grains (0.06–0.13). Three grains is the maximum dose. One dose at bedtime is often all that is needed. Singularly enough this drug though efficient in major epilepsy does little good in petit mal. Certain cases of typical migraine are benefited by ½-grain doses morning and night taken over a long period of time. Luminal is contraindicated in the presence of advanced pulmonary disease, acute and chronic nephritis and in the presence of definite asthenia. Like all members of the barbituric acid group, this drug if taken repeatedly may induce not only great hebetude but even a stuporous delirium. This is particularly true in the acute infections and in the presence of renal disease. Phenobarbital very rarely causes an erythematous maculo-papular rash with great itching and still more rarely fever, feebleness and vertigo. As it is insoluble in water it is best given in tablet or capsule.

Luminal sodium or phenobarbital sodium is much more soluble in water and may be given in 20 per cent solution if need be by the hypodermic needle in the dose of 1 to 2 grains, or by the mouth in the dose of 2 to 8 grains (0.12–0.5), although the latter amount is rarely needed. Hypodermically it has given excellent results in arresting the *status epilepticus* and in *tetanus* given daily in 2-grain doses in 2 cc. of distilled water over long periods of time in subacute and chronic cases. It may also be given intraspinally in the dose of 3 to 5 grains (0.2–0.3) in 10 cc. of normal saline after withdrawal of that amount of spinal fluid. (See Barbital and Dial.)

Under the name of Peralga a combination of amidopyrine and phenobarbital is used for the relief of *insomnia due to nerve pains*, in the dose of 3 grains (0.2).

PHENOL (CARBOLIC ACID).

Phenol, U. S., and *Acidum Carbolicum*, B. P., is also known as phenylic alcohol and phenic acid. Not only is it an acid, but in addition it is an alcohol of the peculiar group known as the phenols, which are derived from coal-tar by a process of distillation. Its acidity is, however, very feeble. The official phenol should assay not less than 96 per cent of absolute phenol.

Phenol is sold in several grades, No. 1 being the purest. Both Nos. 1 and 2 are crystalline, while Nos. 3, 4, 5 are impure because of the presence of cresylic acid and other foreign substances. Only No. 1 should be ordered when phenol is to be given by the mouth.

Phenol has a characteristic odor, and varies in color according to its method of preparation and purity. It is soluble in 15 parts of water, but it is liquefied by the addition of 8 per cent of water. Phenol should be kept in dark amber-colored, well-stoppered bottles.

If the crystals be exposed to the air, they undergo liquefaction, and in consequence the purest phenol is usually prescribed in minim doses rather than in grains. It is soluble in alcohol, ether, chloroform, glycerin, and most oils. It unites with alkaline bases to form salts, carbolates; but these are readily decomposed, even by the feeblest acids, such as carbonic acid.

Physiological Action.—Locally applied to the skin, phenol produces at first a burning sensation, accompanied by a diffuse reddening of the surface. If the solution be strong, the part at once becomes temporarily painful, then bleached and numb, so that tactile sensibility is destroyed. Applied to mucous membranes, it causes similar changes, but to a more marked degree, and may even act as a moderately severe caustic of a superficial type. Owing to the coagulation of albumin produced when it is applied, it cannot cauterize the tissues very deeply.

NERVOUS SYSTEM.—Phenol acts as a depressant and paralyzant to the peripheral sensory nerves when locally applied.

Upon the higher centers in the brain the acid in toxic dose produces a condition of depression and stupor.

The convulsions which sometimes occur after toxic doses have been taken are spinal in origin, as they occur after section of the spinal cord.

RESPIRATION.—Lethal doses almost invariably kill by failure of respiration due to depression of the respiratory center. After large doses the breathing becomes more rapid and full.

TEMPERATURE.—Phenol acts as a feeble depressant to normal bodily temperature even when given in medicinal dose, and also decreases the bodily heat in fever. It lowers fever by diminishing heat production and increasing heat dissipation. This antipyretic power is hardly sufficient to permit of its use in disease for this purpose.

KIDNEYS and ELIMINATION.—When phenol is given in overdose, the kidneys may become so irritated that total urinary suppression may occur. When taken in large quantity, it causes the urine to become brownish-black. This discoloration is due to an educt of phenol which is not yet isolated, perhaps hydrochinon. Phenol is eliminated in the urine as phenol-sulphonate of sodium and potassium and as glycouronic acid and hydrochinon. Part of it is burnt up in the body.

It is to be distinctly understood that the dark urine of phenol poisoning is not due to the presence of blood or of any of its educts.

Poisoning, Prolonged and Acute.—As the changes produced in the tissues of the body by acute and subacute poisoning by phenol are in many respects identical, they may be considered together.

Phenol is one of the most deadly and rapidly acting poisons known, although this fact does not seem to be generally recognized. If a large lethal dose be swallowed by a man, he may drop dead from its effects before he can go more than a few feet from the spot where he stood when drinking the drug, or he may live a few hours. In cases where death has occurred suddenly from taking this acid the direct cause has been failure of respiration. If the patient does not die at once, all the evidences of gastro-enteritis come on. Violent vomiting and purging may ensue, and burning pain in the entire abdomen is a prominent symptom. The skin is wet with sweat, the face pinched and anxious. Collapse, with a thready, imperceptible pulse and extreme dyspnea, may be present. The mouth and lips may not smell of the drug, but the mucous membrane will be seen to be corrugated and stained black if impure acid has been taken, or be whitish if the pure drug has been used. The eschar on the mucous membrane is a peculiar one, and is pathognomonic of the poison, having a white center surrounded by a reddened and inflamed zone, the center sometimes becoming dark brown or black. The postmortem will show these spots in the esophagus and stomach, and even in the intestines. All the internal organs, as the brain, kidneys, liver, and spleen, will be found filled with dark grumous blood, and on opening the body the odor of the acid will be perceived. A peculiar croupous exudate is sometimes found in the bronchial tubes, and fatty degeneration of a more or less widespread type often follows phenol poisoning. Langerhans has noted that in some of these cases evidences of croupous pneumonia exist. A very common symptom is hoarseness of the voice due to an effect on the larynx after the drug is absorbed, and not from its local influence.

A large number of cases are on record in which subacute phenol poisoning has been produced by its absorption from surgical dressings. The earliest signs of such an accident are the darkened, smoky hue of the urine and slight nervous unrest or cerebral disturbance. Very often pain in the lumbar region indicates kidney irritation. The dressings should be, of course, at once removed.

Treatment of Poisoning.—The chemical antidotes to phenol are generally considered to be any non-poisonous soluble sulphate such as Epsom or Glauber's salt, which are supposed to form insoluble sulphocarbolates, the latter being preferable to other soluble sulphates in that they also act as purgatives if freely used. Sollman and others have recently asserted, as the result of an experimental investigation, that the sulphates are useless, but there seems to be strong evidence that these soluble sulphates are of value in some instances at least. In those instances in which the symptoms are subacute, the intravenous injection of sodium sulphate may do much good because the acid combines with the soluble sulphate and so is rendered harmless. The further treatment consists in hot applications to the extremities, the hypodermic injection of cardiac and respiratory stimulants, such as digitalis and strychnine, intravenous injection of normal saline, and the use of morphine to relieve pain. The stomach-pump should be used if possible.

When *phenol has been spilled on the hands, its effect can be overcome if the hands are immersed at once in absolute alcohol.* There is no satisfactory explanation of this extraordinary effect. Alcohol is useless as an antidote when phenol has been swallowed because absolute alcohol is also an active poison.

Therapeutics.—Internally phenol is little used, but, nevertheless, has a very favorable effect in certain states. In *nervous vomiting* or in that due to *gastric irritation* the drug does good in ½ to 2 minims (0.03–0.12) doses by depressing the sensory nerves in the stomach.

In *diarrhea* depending upon fermentation from 2 to 4 minims (0.1–0.25) of phenol do great good, particularly if combined with 10 to 20 grains (0.6–1.3) of bismuth administered in powder or capsule.

In *gangrene* and *tuberculosis of the lung* a spray of phenol in water in the strength of 5 to 15 minims (0.3–1.0) to the ounce (30.0) may do some good, and at least control the *cough* and relieve the irritation and *tickling in the throat.*[1] (See Part III, Inhalations.) Creosote is, however, generally preferred in these conditions.

In *diphtheria, ulcerated sore-throat,* and even in ordinary *stomatitis,* phenol will be found of value when used in a spray or mouth-wash in the proportion of 1 part to 75 parts of water; and in ordinary *sore-throat* or that due to sepsis, in the strength of 1 part to 100 of water it will be found, when applied on a swab or by a gargle, to relieve the pain and inflammation. By means of a stick it may be applied pure to the spots in *aphthous stomatitis.* In the treatment of *burns* phenolized sweet oil in the proportion of 1 dram (4.0) of the drug to each 6 ounces (180.0) makes a very good dressing in many cases By means of the local anesthesia produced by the drug, minor operations, such as *eversion of an ingrowing toe-nail* or opening a *felon,* may be performed by applying the pure drug by means of a brush to the line of the incision. Phenol may be used as a lotion in the *itching of jaundice* in the proportion of 10 grains (0.6) of the drug to 2 drams (8.0) of glycerin and 2 drams (8.0) of water, or, better still, 4 drams (16.0) of sweet oil.

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[1] The spray must be a very fine one, or it will not carry the drug far enough down into the lungs to be efficacious.

In the form of an ointment phenol may be used in the strength of 10 minims to 1 ounce (0.6–30.0) of simple cerate, particularly in cases of *subacute eczema* where there is a great amount of weeping. In cases of *eczema* with much itching, and in *pruritus* and *lichen planus,* the following ointment is useful:

℞—Mentholis	gr. v (0.3)
Phenolis	gr. x (0.6)
Unguenti aquæ rosæ	℥j (30.0).—M.

S.—Apply locally.

Several clinicians have recommended the treatment of *smallpox* by touching the vesicles in limited areas each day with a small brush or a stick dipped in the pure drug. It is claimed that in this way pustulation is decreased, secondary fever is diminished, and pitting is lessened.

In *enlarged glands* which have not gone on to suppuration intraglandular injections of phenol by means of a hypodermic needle are of value in a large number of cases, the solution used being no weaker or stronger than 2 per cent; 5 to 10 minims (0.3–0.6) of this solution are sufficient for each gland. In the treatment of *buboes* 10 minims (0.6) of a solution of 8 grains (0.5) to the ounce (30.0) may be injected into the swelling. *Boils* can be aborted by wrapping a bit of cotton around a toothpick, dipping it in the pure acid and then boring it into the center of the boil.

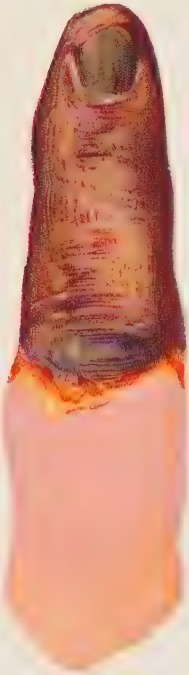
Phenol is rarely used directly over *wounds* in dressings at present unless the dressing be one of phenolized oil. Other drugs, or rigid asepsis, have supplanted it when used in this way, but surgeons have returned to its employment as a useful antiseptic when used in pure form to swab out open wounds that are infected. The use of the phenolized spray over wounds has been found to do more harm than good, and it should never be employed.

A valuable application for *burns, small wounds,* and *abrasions* that are probably infected is one composed of phenol and camphor. Three parts of camphor and 1 part of phenol are mixed, the crystals of phenol being first liquefied by heat. The mixture after several hours becomes perfectly blended and part of its odor is dissipated if the bottle holding it is left open for a few days. This preparation will not harm the tissues nor cause pain as phenol does when not mixed with camphor, and may be applied with absorbent cotton or gauze or with petrolatum. Applied undiluted it is a useful application in *tonsillitis* in its early stages or it may be used 1 to 500 as a gargle in *septic pharyngitis.* A 1 per cent solution may be used on *burns.*

As a *disinfectant* phenol ranks among the poorest: 1 to 2 per cent solutions, however, kill most spores and germs.

Untoward Effects.—Phenol when applied as a dressing, even in as weak a strength as 3 per cent, to a finger or toe may cause gangrene of the part severe enough to destroy it or to require amputation, but

PLATE I



PHENOL GANGRENE

Appearance of a finger four weeks after the application for twenty-four hours of a dilute solution of phenol. The finger was wrapped in cloths which were saturated with the carbolic solution not stronger than five per cent. Amputation necessary. Inflammatory process at the base of the finger shown by the reddened tissues. (Harrington's case.)

my former dermatological colleague, the late Dr. Stelwagon told me that he had never seen this untoward effect although he often employed the drug. The explanation of this effect may lie in the fact that the finger is often suffering from a lacerated and contused wound and thereby devitalized. Such strengths applied to the skin of the trunk rarely produce evil effects, probably because the circulation is not so completely cut off by the action of the drug on the bloodvessels. (See Plate I.)

Administration.—Phenol ointment (*Unguentum Phenolis*, U. S.; *Unguentum Acidi Carbolici*, B. P.) and the glycerite (*Glyceritum Phenolis*, U. S.) and liquefied phenol *Phenol Liquefactum*, U. S.) are the only official preparations of phenol in the U. S. P. In the B. P. the following preparations are official: *Acidum Carbolicum Liquefactum*, given in the dose of 1 to 2 minims (0.05–0.1); *Glycerinum Acidi Carbolici, Trochiscus Acidi Carbolici*, and *Suppositorium Acidi Carbolici*.

PHENOLPHTHALEIN.

Phenolphthaleinum, U. S. and B. P. originally used as a test for acids and alkalies, has come to be generally employed by many practitioners as a laxative to overcome *habitual constipation*. It may be given in pill or tablet. When given in the ordinary dose of 1 to 2 grains (0.006–0.12) at bedtime it produces a free evacuation without griping and no effect on the general system, even when given over a long period of time. It is eliminated almost entirely in the feces, but if taken constantly a skin eruption called *erythema persistans* sometimes develops and then changes into an *erythema circinata*. The small amount absorbed from the bowel when eliminated by the kidneys may give the urine a distinct pink color if that fluid is alkaline. As much as 30 grains are non-toxic but irritating to the intestinal mucosa.

PHENOLSULPHONATE OF ZINC.

The phenolsulphonate of zinc (*Zinci Phenolsulphonas*, N. F.) is largely employed by some practitioners as a mild antiseptic local stimulant, either in powder or in solution, on *ulcers* and *sores*. Much more commonly it is given internally for the production of gastrointestinal antisepsis when there is *diarrhea* with fetid, ill-smelling stools, as in the bowel disorders of hot weather in children or adults, or in the course of *typhoid fever*. How much good it does in the latter disease, so far as the disease itself is concerned, is uncertain, but it undoubtedly renders the stools less foul and tends to check the diarrhea. The dose is 2 to 3 grains (0.12–0.2) in pill four or five times a day. The phenolsulphonate is probably eliminated from the body unchanged. Sometimes good results follow the use of cascara sagrada with this salt in cases of *constipation* with *flatulence* and signs of *auto-intoxication*.

PHENYL SALICYLATE.

(See Salol.)

PHOSPHORIC ACID.

The pure acid is rarely employed in medicine, but when given is used in 2- to 8-minim (0.1–0.5) doses. In the form of dilute phosphoric acid (*Acidum Phosphoricum Dilutum,* U. S. and B. P.) it is widely employed in the dose of 20 minims to 1 dram (1.3–4.0), 5 to 20 minims (0.3–1.2), B. P., as a tonic and gastric stimulant. It is not a food to the nervous system, does not resemble phosphorus in its physiological action, and is not to be employed in its place. It does good in *nervous exhaustion* simply by stimulating the stomach and thereby aiding that organ in the digestion of food. Phosphoric acid is also official in the B. P. as *Acidum Phosphoricum Concentratum.*

PHOSPHORUS.

Phosphorus, U. S. and B. P., is a non-metallic element, generally obtained from bones, and is very soluble in oils, less so in ether and alcohol. Its odor is characteristic and peculiar. When placed in a dark room after exposure to light it is luminous, and if exposed to the air will ignite. It should be kept under water in tightly-stoppered bottles. Very commonly it is contaminated by arsenic and sulphur.

Physiological Action.—Phosphorus is found in large amount, comparatively speaking, in the bones and in the nervous system.

Upon the growth of bones phosphorus when it is given to young animals may cause a great increase in the size of these parts. The first change noted is an enlargement, which consists in a jelly-like mass containing little or no bone salts, and this is finally converted into a very hard material which may fill the entire canal in the center of the bone. Kissel has stated that this does not occur, but his results must be doubted in view of the thorough studies of Wegner. Unfortunately this effect does not occur in man but it would appear probable that if ultra-violet light is used at the same time that phosphorus is given it may be of value. (See Vitamines.)

Acute and Chronic Poisoning.—When phosphorus is taken in poisonous dose, often from the ends of certain matches, no symptoms may come on for eight or ten hours. At the end of that time the peculiar taste of phosphorus may be noted in the mouth, the breath is heavily laden with its odor, and burning pain in the esophagus, stomach, and abdomen becomes a pressing symptom. Vomiting and purging now assert themselves, and both the matters which are vomited and those which are passed from the bowels may be luminous in the dark, owing to the presence of phosphorus. The vomit at first consists of food, then mucus, then bile, and then perhaps blood. All the symptoms of a mild gastro-enteritis may develop, but it is to be noted that constipation of an obstinate type may be present instead of purging. Very soon the liver increases in size, and gives rise to general hypochondriac pain and tenderness as well as local swelling. At the end of twenty-four hours, or perhaps after the second day, a cessation in the symptoms occurs, and, if the physician be not on his guard, this will lead him to a hopeful prognosis, but in the course of a few hours jaundice begins in the conjunctiva and then extends over the entire body. With the onset of jaundice the vomiting and pain return with renewed vigor. The matters vomited have often the color of "coffee grounds," due to exuded and altered blood. The bowels are absolutely confined, or the few hard masses of fecal matter which are passed are white and clay-like because of the absence of biliary coloring matter. There is no bile in the vomit in this stage, because the hepatic ducts have been closed by the inflammation which has been produced in the liver. Later, nervous symptoms ensue. Muscular twitchings, headache, vertigo, wild delirium, erotic convulsions, and, finally, unconsciousness and death occur. Sometimes the convulsions occur just before dissolution. Even if the patient survives the acute stage of the poisoning, he generally dies of the changes produced in his vital organs, which consist in widespread fatty degeneration. These fatty changes occur even in the acute form of the poisoning. Atrophy of the liver, destruction of the gastric tubules, pancreatic involvement, and kidney degenerations aid in producing the ultimately fatal results.

During poisoning by phosphorus the urine is scanty and perhaps albuminous, and is peculiar because of the unusual substances which are found in it. The most unusual of these is sarcolactic acid, which results from breaking down of the muscular tissues. Leucin and tyrosin are also found, and tube casts with fatty globules in them are seen. Free fat-globules may also occur. Bile acids and bile coloring matter are found in large amount, and the urine is generally dark colored for this reason. As phosphorus is eliminated in the urine as hypophosphoric acid, this substance is also present.

The symptoms of phosphorus poisoning may so closely resemble those of acute yellow atrophy of the liver as to make a differential diagnosis impossible unless some evidence of the presence of phosphorus is obtainable.

In chronic poisoning by phosphorus, usually caused by the inhalation of its fumes, by far the most common lesion is necrosis of the lower jaw, which may be widespread or limited. The phosphorus by attacking the periosteum exposes it to infection, and pyogenic organisms attack the bone. Sometimes the tubercle bacillus causes the necrosis. Phosphorus necrosis never occurs in those who have no solution of continuity in the teeth or gums. It has been said that pans containing turpentine when set around the work-room will protect the workmen, but this is certainly incorrect. Since laws have been passed forbidding the use of yellow phosphorus in the making of matches this condition is very rarely seen. Some cases develop in the making of phosphor-bronze. The red amorphous phosphorus and the sesquisulphide used in safety matches is non-poisonous.

Treatment of Acute Poisoning.—The antidote to phosphorus is generally taught to be the sulphate of copper, which will also act as an emetic if given in excess, but studies made by Thornton in my laboratory at the Jefferson Medical College prove that when given in a dose large enough to be efficient it is as dangerous a poison as the phosphorus. Peroxide of hydrogen or permanganate of potassium are probably the best antidotes, as they convert the phosphorus into phosphoric acid. Oil of turpentine, in America, is not only valueless as an antidote, but harmful, for only old, ozonized French oil of turpentine is antidotal in its influence. As phosphorus is soluble in oils, we simply aid in its absorption if any such substance are given.

Therapeutics.—Owing to its influence on the development of bone, phosphorus has been used in *rachitis* and *osteomalacia*. It is also useful in the *sweats* of general or *nervous debility* and in *nervous exhaustion*, and in some cases of *melancholia* depending upon overwork. In the course of prolonged exhausting diseases, as *typhoid fever* or *typhoid pneumonia*, the drug is of service if the nervous system seems to be particularly affected, and in convalescence it is of service in aiding to build up the shattered forces of a patient.

In the sequelæ of *acute* and *chronic alcoholism* and in *morphiomania* it is of service. Phosphorus is also employed in *sexual exhaustion* or abuse. In *boils* and *carbuncles* and similar disorders phosphorus is useful, particularly so in *acne indurata*. In *pneumonia* some physicians use minute doses with the belief that it aids in the production of resolution. Probably it does good in these cases by stimulating or supporting the nervous system.

In the *neuralgia* from *nerve depression* and in *cerebral softening* and *meningitis* of a chronic type phosphorus may be given.

All these statements are based upon the opinion of other writers and the author wishes to state that his use of this drug has been disappointing.

The dose of phosphorus is $\frac{1}{100}$ to $\frac{1}{50}$ grain (0.0006–0.0012) in pill form (*Pilulæ Phosphori*, U. S. and B. P.), but it may be gradually pushed to $\frac{1}{20}$ grain (0.003) if urgently needed. Phosphorated oil (*Oleum Phosphoratum*, B. P.) and *Spiritus Phosphori* are given in the dose of 1 to 5 minims (0.05–0.3). *Elixir Phosphori* is given in the dose of 15 minims to 1 dram (1.0–4.0).

The beginning dose of phosphorus should not be above $\frac{1}{100}$ grain (0.0006), for fear of some idiosyncrasy.

PHYSOSTIGMA.

Physostigma (*Physostigmatis Semina,* B. P.) is a seed derived from *Physostigma venenosum,* often called Calabar bean. It contains two alkaloids, eserine, or physostigmine, and calabarine. The former is the more important from a medical point of view.

Physiological Action.—When a very large dose of physostigma is given by the mouth it often produces some pain in the stomach and a sense of oppression and weakness. The pulse becomes slow, the respiration is depressed, and the pupils are contracted. Calabar bean in poisonous dose is a general paralyzant, but if the alkaloid calabarine be present in excess, it may be convulsant.

NERVOUS SYSTEM.—In medicinal doses the drug is a stimulant to unstriped muscular fiber and acts as a mild nervous sedative.

CIRCULATION.—In medicinal dose its circulatory effect is not marked, but is depressant rather than stimulant.

RESPIRATION.—In moderate amount calabar bean does not affect respiration, but in poisonous dose it produces death by paralysis of the respiratory center.

PUPIL.—Physostigma causes myosis or contraction of the pupil by stimulation of the circular muscular fibers of the iris, and not by depression of the sympathetic fibers nor by stimulation of the oculomotor fibers, nor again by causing contraction of the blood-vessels of the iris. It decreases intra-ocular tension, produces temporarily an increase in the power of accommodation for near objects, and then causes spasm of accommodation. The myosis usually develops in about eight to fourteen minutes after the drug is dropped in the eye, and reaches the maximum in thirty minutes, lasting for from six to eight hours. The partial influence may last, however, for four or five days.

ALIMENTARY TRACT.—Physostigma is a stimulant to intestinal peristalsis, increasing the muscular activity in the walls of the gut and acting as a tonic to these fibers.

Poisoning.—Poisonous doses of physostigma cause muscular tremors, followed by complete muscular relaxation. The pupils contract, the respirations become slow and irregular, and all reflex action fails. Vomiting or purging may or may not occur.

TREATMENT OF POISONING.—This consists in the use of atropine, which is the physiological antidote; in the application of heat to the body, and the use of respiratory and cardiac stimulants, such as digitalis, alcohol, or ammonia.

Therapeutics.—Calabar bean has been employed in many affections, such as *trismus neonatorum, tetanus,* and other *spasms,* with only moderately good results. It is, however, of value in atony of the bladder and intestine and in catarrh of the bowels. Combined with nux vomica the author has used eserine with advantage in cases of *gastric* and *intestinal dilatation.* Some physicians think it of value in cases of *tympanites,* but in a limited use of it in certain severe cases of pneumonia with tympanites the writer has not found it of value.

It has also been used advantageously by surgeons to overcome *postoperative tympanites* in the dose of $\frac{1}{30}$ grain (0.002) by hypodermic injection with or without strychnine. I have never seen it do good and I have seen it produce collapse.

In *bronchial asthma* and *emphysema* it aids in expulsion of the mucus by its influence over the muscular fibers in the walls of the air-tubes. It is also useful in purgative pills to stimulate the muscular fibers of the intestine. (See Constipation.)

In the eye, in the strength of 1 to 2 grains to 1 ounce (0.06–0.12:30.0) of water, eserine is used in the treatment of *corneal ulcerations,* for the relief of *glaucoma,* and to diminish high intra-ocular tension. If, for any reason, *atropine mydriasis* is to be rapidly overcome, eserine may be used, but it is not so powerful a myotic as atropine is a mydriatic, and it requires larger amounts of the solution to produce contraction than it took of atropine to cause mydriasis.

Administration.—Physostigma is used in the form of the extract (*Extractum Physostigmatis,* B. P.) in the dose of $\frac{1}{8}$ grain (0.008), which may be readily increased to $\frac{1}{4}$ grain (0.015), $\frac{1}{4}$ to 1 grain (0.015-0.06), B. P.

Eserine is usually employed in the form of *Physostigminæ Salicylas,* U. S., and may be used in the dose of $\frac{1}{80}$ grain (0.0008) three times a day. The sulphate is less irritating, and is generally to be employed. The salicylate is largely used, nevertheless, by ophthalmologists. *Lamellæ Physostigminæ,* B. P., each contain $\frac{1}{1000}$ grain (0.00006) of physostigmine sulphate. The dose of both salts of eserine is $\frac{1}{100}$ to $\frac{1}{80}$ grain (0.0006–0.0008).

PICRIC ACID.

Picric acid, *Trinitrophenol,* U. S. (*Acidum Picricum,* B. P.), occurs in light yellow scales or needles without odor, and is chiefly used in the arts as a dye. Its uses in medicine are limited. It has been found exceedingly efficacious in solution in the treatment of severe *burns* and *scalds.* This solution is made as follows:

℞—Acidi picrici	gr. lxxv–ʒij (5.0–8.0)
Alcoholis	f℥iiss (75.0)
Aquæ destillatæ	Oij (960 cc).—M.

After the burn is cleansed of dirt and charred clothing, strips of sterilized gauze are soaked in this solution and applied to the part. Over this is placed a pad of dry absorbent cotton which is fastened by a light bandage. The dressing rapidly dries, and may be left in place for several days. It is then moistened with the solution so as to soften it, is removed, and then a fresh dressing is applied for a week. All blisters should be pricked. At first the acid causes some pain, but in a short time this dressing relieves pain. It prevents suppuration, hastens healing, and results in a smooth cicatrix. As this dressing stains the hands, the physician should use rubber gloves when applying it. The existence of marked renal irritation should make us cautious in applying this acid solution to large surfaces, lest absorption occur. (See Burns, Part IV.)

Picric acid in 5 per cent solution may be advantageously used as a substitute for tincture of iodine to *disinfect the skin* prior to operation. It possesses the advantage that the skin does not have to be dry when it is applied as is the case with iodine.

To remove the stain of picric acid from the skin, wash the hands in a solution of lithium carbonate in water in the strength of 1 dram (4.0) to 1 quart (1000 cc.).

PILOCARPUS.

Pilocarpus is the leaflets of a South American tree, *Pilocarpus microphyllus*, or *Pilocarpus jaborandi.* It contains two alkaloids, known as pilocarpine and isopilocarpine. Jaborine is a combination of these alkaloids and a resinous substance. The alkaloid pilocarpine is non-crystallizable and occurs as a soft mass, but the salts of pilocarpine are crystallizable.

Physiological Action.—When pilocarpus is taken in medicinal dose by a healthy man it causes a deep flushing of the face and neck, followed by the outbreak of a profuse sweat, which, though beginning in these regions, rapidly spreads over the entire body. Accompanying the sweat, salivation is often exceedingly profuse, so that saliva dribbles from the mouth. The sweat lasts from two to five hours. Nausea frequently comes on, and severe vomiting may appear in susceptible persons either during or after the sweating. Some individuals are singularly insusceptible to the diaphoretic influence of pilocarpus and this is particularly so, according to Ringer, with children, who will often take as much as 60 grains (4.0) of the crude drug before they perspire.[1] Such a dose is dangerous.

NERVOUS SYSTEM.—Moderate doses given to men have no effect on this part of the body.

CIRCULATION.—In large doses there is no doubt that jaborandi acts as a cardiac depressant rather than a stimulant. The drug does not slow the pulse, but quickens it very markedly, often as much as 40 to 50 beats per minute. Although the pulse in animals is generally made stronger by its use, in man it is generally made weaker.

STOMACH.—Jaborandi sometimes produces nausea and vomiting by irritating the stomach and perhaps the vomiting center.

[1] The writer has reported a case (see Idiosyncrasy) in which a woman of thirty years received ¾ grain of the muriate of pilocarpine hypodermically in half an hour without any effect.

Temperature.—Jaborandi lowers bodily temperature to a considerable degree, probably by the dilatation of the peripheral capillaries and the profuse sweat which it produces. This fall is sometimes preceded by a brief rise.

Kidneys and Tissue-waste.—Upon the kidneys jaborandi acts very slightly or very strongly, according to the dose that is given. Large doses, which produce a profuse sweat, naturally decreases the urinary secretion, but small ones undoubtedly increase it. Upon the tissue changes in the body under pilocarpine no researches have been made, but it is an undoubted fact that in disease the excretion of urea is largely increased under the influence of this drug.

Eye.—Jaborandi contracts the pupil by stimulating the peripheral ends of the oculomotor nerve in the iris.

Skin and Secretion.—The amount of sweat caused by the drug in man may equal as much as a pint, and it is generally first acid, from the secretions of the sebaceous glands, then neutral, and finally alkaline. The sweating is not primarily due to vasomotor palsy, but to stimulation of the ends of the nerve supplying the glands and of the sweat glands themselves. The sweat usually lasts about two or five hours. Sometimes excessive salivary secretion supplants that of the skin.

Pilocarpine increases the gastric, salivary, and lacrimal secretions, as well as that of the skin and kidneys. It also seems to have considerable influence over the secretion of milk.

Therapeutics.—Jaborandi, or, better still, its alkaloid, pilocarpine, is of some value for the relief of *dropsy* of the renal type. (See below.) In cardiac dropsy it is generally too depressing, and the author knows of more than one case in which a fatal result speedily followed its use under these circumstances. For pleural transudates it has been used, but more efficient remedies are elaterium, or salines given in concentrated form and at the proper time of the day. (See Magnesium Sulphate and Dropsy.) Better than all these is thoracentesis. Spaulding and de Schweinitz have both recommended very highly the hypodermic use of pilocarpine in the dose of $\frac{1}{12}$ to $\frac{1}{10}$ grain (0.005–0.006) a day for *opacities of the vitreous humor* of the eye. The fluidextract of jaborandi may be employed, but is apt to nauseate the patient. Diaphoresis should not be produced. Because of its myotic influence on the pupil pilocarpine is of very great value in the treatment of all conditions of the eye associated with *increased intra-ocular pressure.* It is so good a myotic as to be rapidly supplanting eserine for this purpose with some clinicians. The strength of pilocarpine solution for this purpose is 1 to 4 grains (0.06–0.25) to the ounce (30.0). It should be dropped into the eye, 1 or 2 drops at a time, every hour until the patient is relieved. Pilocarpine is also useful as an ocular tonic to relieve eye-pain after excessive use of the eyes, in the strength of $\frac{1}{10}$ grain (0.006) to the ounce (30.0). A few drops of this solution may be dropped into the eye three times a day. This solution should have a little boric acid (4 grains) added to it to prevent fungus growth (See Asthenopia.) A useful formula is as follows:

℞—Pilocarpini nitratis	gr. 1/20 (0.003)
Holocainæ hydrochloridi	gr. j (0.06)
Aquæ destillatæ	f℥j (30.0)

S.—Use as an eye tonic dropped in eyes t. i. d.

Clinical reports show that pilocarpine in small doses is a good remedy in *tobacco* and *alcoholic amblyopia.*

Mitkowski has tried pilocarpine in *catarrhal jaundice* of a persistent type with great benefit, in the hypodermic dose of ⅙ grain (0.01) every other day for three weeks. In *uremic poisoning* pilocarpine is theoretically the most efficient and rapidly acting remedy that we have, and when used in *Bright's disease* it may be of value; but the frequency with which its use has been followed by pulmonary edema or a transudation of fluid into the bronchi has very properly made many practitioners afraid to employ it.

Care should always be exercised in the use of the drug lest cardiac depression ensue, and alcohol or strychnine may often be used with advantage to guard against this accident. The general consensus of opinion is that in the nephritis of middle or advanced life with cardiac changes it is contraindicated. The author never uses it in nephritis. In the convulsions of pregnancy pilocarpine, while theoretically useful, has been proved by experience to do more harm than good through its depressing influences, and it often precipitates pulmonary edema. The hypodermic dose of pilocarpine as a renal stimulant should be about 1/30 to 1/20 grain (0.002–0.003).

In cases of obstinate *aural vertigo* a most efficient treatment is the hypodermic use of pilocarpine every few days in sufficient dose to produce some salivation. The patient must lie down or go to bed after the dose is given.

Pilocarpine certainly has a decided effect in encouraging the growth of hair, and applied locally will often do good in partial *baldness.* If too much pilocarpine is used, it is apt to cause the development of small pustules about the hair-follicles. Bartholow recommended the following application for baldness:

℞—Fluidextracti pilocarpi	f℥j (30.0)
Tincturæ cantharidis	f℥ss (16.0)
Linimenti saponis	f℥iss (45.0).—M.

The author has found the following prescription very efficacious in falling of the hair.

℞—Fluidextracti pilocarpi	fʒj (4.0)
Tincturæ capsici	f℥j (30.0)
Tr. cantharidis	fʒss (2.0)
Olei ricini	fʒj (4.0)
Alcoholis q. s.	f℥iv (120.0).—M.

S.—Apply with friction in spots to the scalp, night and morning.

Antagonisms of Jaborandi.—Jaborandi is a physiological antidote to atropine and to agaricin. Four times the dose of pilocarpine must be used to counterbalance a dose of atropine. Vomiting produced by pilocarpus is to be antagonized by morphine.

Untoward Effects.—Dimness of vision, vomiting, sudden collapse swelling of the salivary glands and tonsils, hiccough and strangury are sometimes met with after using pilocarpus. Sometimes bloody leucorrhea is seen. The vomiting can usually be prevented by full doses of chlorodyne. Occasionally pulmonary edema develops.

Prentiss has called attention to the fact that the continued use of pilocarpine may cause the hair to become coarse and dark.

Administration.—The dose of jaborandi is 40 grains (2.6) used in the form of the powdered leaves in infusion. The fluidextract (*Fluidextractum Pilocarpi; Extractum Jaborandi Liquidum,* B. P.) is given in the dose of 10 to 40 minims (0.6—2.6), 5 to 15 minims (0.3–1.0), B. P. Pilocarpine is far superior to jaborandi, in that it does not so often produce nausea and vomiting. It is used in the form of the hydrochloride (*Pilocarpinæ Hydrochloridum,* U. S.), in the dose of from $\frac{1}{8}$ to $\frac{1}{2}$ grain (0.008 0.03) hypodermically, or $\frac{1}{4}$ to $\frac{1}{2}$ grain (0.15–0.03) by the mouth and in the form of the nitrate (*Pilocarpinæ Nitras,* U. S.) in the same dose as the hydrochloride.

The additional preparations of the B. P. are—the tincture (*Tinctura Jaborandi*), dose $\frac{1}{4}$ to $\frac{1}{2}$ fluidounce (8.0–16.0); and the nitrate of pilocarpine (*Pilocarpinæ Nitras*), $\frac{1}{8}$ to $\frac{1}{2}$ grain (0.008–0.03).

PIMENTA.

Pimenta, or *Allspice,* contains an official volatile oil (*Oleum Pimentæ,* B. P.), used for flavoring purposes, as a constituent of spice plasters, in diarrhea mixtures or as a carminative. It will also prevent the griping of purgative medicines. The dose of the oil is 1 to 5 minims (0.06–0.3). *Aqua Pimentæ* (B. P.) is given in the dose of 1 to 2 ounces (30.0–60.0).

PITCH.

Pix is a resinous exudation derived from several species of pines, firs, and spruces, and is, in one of its forms, obtained by the evaporation of wood-tar. It is used for various purposes, according to its derivation. Burgundy pitch (*Pix Burgundica,* B. P.) is derived from Norway spruce, or *Abies* (*Picea,* B. P.) *excelsa,* a plant of Europe and Asia. It softens and melts at the temperature of the body and is useful for plasters. In *muscular rheumatism* and in *chronic bronchitis* pitch is a mild and fairly useful local remedy for external use. In the form of the plaster (*Emplastrum Picis,* B. P.), and in the form of warming plaster (*Emplastrum Picis Cantharidatum*), it is employed for the relief of deep-seated *sprains* and *bruises,* and acts as a mild counterirritant, which may blister a tender skin.

Canada pitch (*Pix canadensis*) is obtained from the hemlock spruce of Canada and the United States, and is used for the same purposes as Burgundy pitch. The Canada-pitch plaster (*Emplastrum Picis Canadensis*) is employed for the same conditions as the plaster of Burgundy pitch.

PITUITARY GLAND.

Our knowledge of the functions of the pituitary gland is as yet incomplete, but it is evident that they are multiple. (See below.)

The posterior lobe (infundibulum) of the pituitary gland is now largely used in medicine. In dried form it is official in the U. S. P. as *Pituitarium,* and a liquid extract is also official as *Liquor Pituitarii,* U. S. The preparation in liquid form most generally used for all purposes is called "pituitrin."

The *physiological action* of this substance when given intravenously is almost identical with adrenalin in that it is a stimulant to the muscular coats of the bloodvessels, but its action, although more prolonged than that of adrenalin, is less powerful and less rapid in onset. It slows the pulse-rate. Locally applied to mucous membranes it induces a similar ischemia to that caused by adrenalin. Upon the parturient uterus it acts as a powerful stimulant. It also stimulates intestinal peristalsis and the muscular coats of the bladder. It also in some cases increases the secretion of milk.

Therapeutics.—Pituitrin should be used intramuscularly and intranasally and, for the reasons just given finds its chief use as an *oxytoxic* which is not to be given until the os is dilated to the size of a quarter of a dollar and until the physician is sure that the birth canal is not obstructed. Its action is so prompt that after it is given the physician should not leave the patient. If after its use labor threatens to be too precipitate, chloroform should be given. It has largely displaced the forceps in slow labor due to feebleness and *uterine inertia.* It is of great value in *postpartum hemorrhage.* The advantage of the intranasal method is that the pledget of absorbent cotton wet with the solution may readily be removed as soon as the oxytoxic effect of the remedy is as great as is desired. It should never be used to hurry delivery in perfectly normal labor. This drug is also used as a circulatory stimulant in *collapse,* to control surgical *shock,* for the relief of *postoperative intestinal torpor* and to remove *tympanites* in the course of the acute infectious diseases. In such cases ten minutes should elapse after the dose before a rectal injection or a turpentine stupe is applied. So too in *acute gastric dilatation* ten minutes should elapse before the stomach tube is passed. It is also used in *atony of the bladder.* When used as an oxytoxic the dose is usually 5 to 10 minims (0.3–0.65), but one-half or one-third of this amount is often sufficient and safer for it does not produce normal intermittent pains but a firm contraction. Twice or thrice these amounts are used to stimulate peristalsis. Where used locally to constrict engorged mucous membranes, as in *hay fever* and *acute rhinitis*, it is best to dilute it from three to ten times with normal salt solution. Given too freely it may induce glycosuria. On the other hand, cases occur in which through inactivity of the posterior lobe a high degree of sugar tolerance is established (250-400 grams a day). Such cases present obesity in which the fat is deposited above the clavicles, at the front and sides of the abdomen, on the neck or the arms and about the upper part of the thighs. The temperature is subnormal and the pulse slow. The value of pituitrin in these cases is still to be determined. It should be used hypodermically.

Although, as already stated, the posterior part of the pituitary usually increases urinary flow, nevertheless the administration of pituitrin hypodermically is the best remedy for *diabetes insipidus* so far discovered. Continued use of the hypodermic needle in such a chronic state is often difficult. I have found that if pituitrin solution "0" is diluted with 1 part of water, and sprayed into the nose with an atomizer at bedtime, excellent results may be obtained. Its use by the mouth seems futile. This plan also succeeds in some cases of *asthma*.

Kamm and his co-workers have succeeded in isolating at least two active principles from the posterior lobe each in the form of a stable, water-soluble, powder which is highly potent. One called Pitressin, raises blood-pressure and the other called Pitocin stimulates the uterus. Pitressin is called beta-hypophamine and pitocin alpha-hypophamine. Pitressin seems also to be the principle that possesses anti-diuretic power, which is probably not so much due to a direct effect upon the kidneys as it is upon the ability of the tissues to retain fluid. It would appear probable at this time that pitressin and pitocin will supplant the use of preparations of the whole posterior lobe.

Pitocin is now marketed in ampoules of 1 cc. containing 10 oxytoxic units and is identical in use with pituitrin obstetrical. It is to be used as a substitute for pituitary extract as a uterine stimulant. Pitressin is used as a *vascular stimulant* and in *diabetes insipidus* as a substitute for pituitary extract. It is also marketed in 1 cc. ampoules, each of which contains 20 pressor units, 1 pressor unit being the pressor activity of 0.5 milligram of the powdered pituitary of the U. S. Pharmacopœia.

Contraindications.—Blair Bell of Liverpool, England, thinks pituitary gland is contraindicated during an operation if respirations are feeble, as it decreases respiratory amplitude, and also in cases of ruptured cardiac compensation as he has seen death ensue following its use in such patients. Any obstruction in the birth canal is also a contraindication.

Pituitary gland should not be used as a cardio-vascular stimulant in diabetic coma, since it has been shown to be physiologically antagonistic to insulin which is the great remedy in this state, but on the other hand it may prove of value when through an overdose of insulin a dangerous state of hypoglycemia is induced as it raises blood sugar.

The exact physiological and therapeutic value of the anterior lobe of the pituitary body is still undetermined. It would seem to be indicated in cases of delayed *development in childhood, physical, mental,* and *sexual,* associated with adiposity. Some physicians have prescribed the anterior lobe for *sexual atony* in adults. It is given in the form of the desiccated powder in the dose of 2 to 3 grains (0.1–0.25) three times a day.

Under the name of Antuitrin a clear, sterile, aqueous solution, of the soluble extract of the anterior lobe, is now on the market, put up in sterile ampoules for hypodermic use. The dose of antuitrin is 8 to 16 minims (0.5–1.0) given once a day by the needle. The whole gland is also placed on the market in tablets of 1 grain (0.06), but several of these may be given three times a day in *dystrophia adiposis.*

PODOPHYLLUM.

Podophyllum, U. S., May apple or mandrake, is the rhizome and small roots of *Podophyllum peltatum,* a plant of the United States and Canada. Podophyllum contains a resin, podophyllin.

Therapeutics.—Podophyllum is the slowest-acting purge official in the Pharmacopœia. In small doses it is laxative, but is purgative and almost drastic in larger amounts. In overdose it may produce gastro-enteritis. The drug particularly excites the flow of bile, and is used as a cholagogue. It is best given when the stools are dark in color, calomel being indicated when they are light. The author has found the following prescription useful in cases of *intestinal flatulence* and *indigestion* with *constipation:*

℞—Podophyllin	gr. v. (0.3)
Euonymin	gr. v (0.3)
Leptandrin	gr. v (0.3)
Creosoti	gr. x (0.6).—M.

Fiant pilulæ No. xx.
S.—One pill once, twice or thrice a day.

In children one or two months old who have *hard, stony stools* podophyllin is a good remedy. The dose should be given by dissolving a grain of the resin in a dram of alcohol and using 2 drops or more of this on sugar once or twice a day. In children who suffer from *summer diarrhea,* in which the passages, consisting almost entirely of water, have a peculiar musty smell or a mouse odor, podophyllin in the dose of $\frac{1}{60}$ to $\frac{1}{50}$ grain (0.001–0.0012), repeated every few hours, is of service, seeming to control the passages and make them normal. This treatment will often succeed when all else fails. This statement is also true in regard to the *chronic diarrheas* of adults, though the drug should be given in somewhat larger amounts in such cases. Podophyllin will also check *vomiting* in these doses in some instances, provided that the stomach is depressed and the liver is torpid. It should not be employed if the vomiting is due to irritation or inflammation of the stomach.

Administration.—Podophyllum is used in the form of the extract (*Extractum Podophylli*), dose 1 to 5 grains (0.06–0.3); the fluidextract (*Fluidextractum Podophylli*), dose 2 to 20 minims (0.12–1.3); and more commonly than all, as the *Resina Podophylli*, U. S., *Podophylli Resina*, B. P., or podophyllin, which is the best preparation. The dose of this preparation is from $\frac{1}{20}$ to $\frac{1}{10}$ grain (0.003-0.006) as a feeble laxative, and from $\frac{1}{10}$ to $\frac{1}{2}$ grain (0.006–0.03) as a purge, $\frac{1}{4}$ to 1 grain (0.015–0.06), B. P. The tincture (*Tinctura Podophylli*, B. P.) is given in the dose of 5 to 15 minims (0.3–1.0).

POMEGRANATE.

Granatum, U. S., is the bark of the stem and root of *Punica granatum.* It is seldom used in America in its crude form. It contains an alkaloid known as pelletierine, this alkaloid being a colorless liquid soluble in 20 parts of water and readily miscible with ether, chloroform, and alcohol. When to it acids are added it forms crystalline salts, of which four are used—namely, the tannate, the sulphate, the hydrobromide, and the hydrochloride. The first is most commonly employed, and is a yellowish powder possessing an astringent taste. It is soluble in 235 parts of water and 12.6 of alcohol. Its physiological action needs further investigation, but the drug in poisonous amounts paralyzes the peripheral ends of the motor nerves in a manner closely resembling the action of curare. Sensibility is preserved. The loss of power is chiefly manifested in the lower limbs, in which at first there may be cramps. There may also be nausea and vomiting.

Therapeutics.—Originally, pomegranate was largely used in the form of the rind of the fruit in decoction as a vegetable astringent, but this practice has ceased because of its disagreeable taste and effect upon the stomach. The ailments which were supposed to indicate its employment were serous diarrhea and profuse sweats. In some tropical countries the bark of the root is used as a vermifuge, and it is very efficient in removing the *tapeworm.* It is said that the bark of the root of the wild shrub is much more efficacious than that of the cultivated and more handsome plant. To be effective the dose of the decoction of the bark must be large. The drug is prepared by soaking 2 ounces (60.0) of the bark in 2 pints (960) of water for twenty-four hours and then boiling down to 1 pint (480). A wineglassful (30.0) of this is the dose which is generally given, and it may be repeated every hour until the whole amount is taken. The objection to this line of treatment is that it is unnecessarily severe, often purging and vomiting the patient excessively. The nausea produced is often great. Should purging fail to occur, it is necessary to give castor oil or other purge to dislodge the worm, and it is always necessary to starve the patient for twelve hours before the remedy is tried.

The dose of pelletierine is 3 to 5 grains (0.2–0.3), and the tannate (*Pelletierinæ Tannas,* U. S. and B. P.) is the salt usually employed. Practically, the only pelletierine used is the French preparation of Tanret. This preparation is put up in small vials; each contains a dose of 5 grains of the drug in solution ready to take.

As large doses as 20 grains (1.3) of pelletierine have been used, but as serious paralytic symptoms have ensued after the ingestion of 5 grains by a susceptible woman, not more than this amount should be given. When pelletierine is used, it should always be followed in two hours by a purge. Those who have used it most place great reliance on it. The fluidextract, no longer official, is given in the dose of 20 to 30 minims (1.3–2.0). The B. P. contains one official preparation of pomegranate—namely, the *Decoctum Granati Corticis,* the dose of which is 1 to 2 fluidounces (30.0–60.0).

POTASSIUM ACETATE.

Potassii Acetas, U. S. and B. P., was at one time largely used in the treatment of *acute rheumatism* in the "alkaline method," as when it enters the blood it is changed into an alkaline carbonate. It has been supplanted by the salicylates in the treatment of most cases of rheumatism. The dose should be from ½ to 1 ounce (16.0–30.0) a day. A combination of 10 grains (0.6) of the iodide of potassium and 30 grains (2.0) of the acetate is useful in *subacute rheumatism* in some instances.

In *hepatic torpor* acetate of potassium is exceedingly efficacious, and aids in promoting the flow of bile as well as that of the urine. It has been used in the treatment of the so-called *uric-acid diathesis,* and quickly renders an acid urine alkaline. At one time it was supposed to purify the blood by aiding in the oxidation of effete material.

The dose of *potassii acetas* is from 20 grains to 2 ounces (1.3–60.0), the latter dose being employed only when a purgative effect is desired; but other drugs are more suitable for this purpose.

POTASSIUM BICARBONATE.

This salt (*Potassii Bicarbonas,* U. S. and B. P.) is used for the same purposes as the citrate and acetate of potassium, and, as it is much less agreeable in taste, should not be employed when they can be obtained. The dose of *potassii bicarbonas* is 5 to 40 grains (0.3-2.6), or even as much as 2 drams (8.0) may be given if well diluted with water.

POTASSIUM BITARTRATE.

Potassii Bitartras, U. S., *Potassii Tartras Acidus,* B. P., is sometimes called "cream of tartar," or acid tartrate of potassium. Owing to its stability, it escapes from the body without oxidation, and so differs from the other potassium salts formed by vegetable acids which are changed into alkaline carbonates.

Therapeutics.—The bitartrate of potassium is the most diuretic of the potassium salts, and is used in heart disease with gin or compound infusion of juniper, for the purpose of removing *dropsy.* One ounce (30.0) of the salt is added to 1 pint (480 cc.) of the infusion of juniper berries, and the entire quantity taken in divided doses in twenty-four hours. In *acute renal disease* the drug should be used without the juniper and it should be remembered that if nephritis prevents the free excretion of the potash it may act as a serious depressant. In large doses—½ ounce (15.0)—it acts as a watery purge, but is rarely so used. Where the *urine is thick and alkaline,* bitartrate of potassium is a useful remedy to acidify and make it clear and normal in appearance.

A useful diuretic beverage called "Imperial Drink" is prepared as follows:

Potassium bitartrate	1 ounce (30.0)
Tartaric acid	1 ounce (30.0)
Oil of lemon	12 minims (1.0)
Sugar	16 ounces
Boiling water	1 gallon

Cool and strain.

POTASSIUM BROMIDE.

(See Bromide of Potassium.)

POTASSIUM CARBONATE.

Carbonate of potassium (*Potassii Carbonas,* U. S. and B. P.). This salt is never used in medicine, except to prepare other salts, as it is disagreeable to the taste and is an irritant. (See Potassium Citrate.)

POTASSIUM CHLORATE.

Chlorate of potassium (*Potassii Chloras,* U. S. and B. P.) is a salt of potassium differing entirely in its physiological action from all the other potassium salts, and, with the exception of the cyanide of potassium, is certainly the most poisonous. Not only is it, when locally applied, an irritant to mucous membranes, but when absorbed into the blood in large amounts it causes changes of a serious character in this fluid, and produces acute nephritis if given in overdose.

In dry form chlorate of potassium should never be rubbed with organic substances in a mortar, an as explosion may occur.

Physiological Action.—It has been thought by some that chlorate of potassium gives up a large amount of oxygen to the body, and that for this reason it would be of value in cases of slow asphyxia, such as results from pneumonia or phthisis. It has even been recommended to travellers crossing high mountains where the rarity of the air produced disagreeable effects; but nothing is more absurd than the belief that it gives up oxygen to the body. Chlorate of potassium does give off oxygen when exposed to high heat, but not at the temperature of the body. And so small a dose is essential that only an infinitesimal amount of oxygen could be given off. Nearly all of it escapes from the body unchanged.

When overdoses of the chlorate are taken, it produces sickness of the stomach, headache, pain in the loins and belly, dyspnea, cyanosis, heart failure, and great weakness. Poisonous doses cause the blood to be of a chocolate color, this change being due to the production of methemoglobin. The blood corpuscles are crenated and broken down, and after death the liver, kidneys, and spleen are found softened and filled with broken-down and disorganized blood.

Therapeutics.—Chlorate of potassium is useful in *stomatitis* and in *mercurial sore mouth* as a mouth-wash, or given internally in the following mixture:

℞—Potassii chloratis		gr. xlviij (3.2)
Tincturæ myrrhæ		f ʒss (2.0)
Elixiris calisayæ	q.s. ad	f ℥iij (90.0).—M.

S.—Teaspoonful (4.0) every five hours, or use as a mouth-wash; one teaspoonful to 3 of water.

Owing to the fact that the drug is eliminated by the saliva to a great extent, the mucous membranes affected by stomatitis are constantly bathed by the solution of the chlorate when it is taken by the stomach. If any irritation of the stomach or kidneys exist, the medicament must be used on a swab and none of it swallowed.

In *diphtheria* chlorate of potassium is very commonly employed, but its use is dangerous. Death in many cases of diphtheria is aided by renal irritability, possibly by reason of an acute nephritis, and this drug simply increases the inflammatory process. If the chlorate of potassium is employed in diphtheria, it should be used in solution and applied by means of a swab. (See Diphtheria.)

In *acute follicular pharyngitis* chlorate of potassium is a useful gargle, and Wood recommends the use of a solution made by adding 1 ounce (30.0) of sumach berries, ½ ounce (16.0) of chlorate of potassium, and 1 pint (480 cc.) of boiling water to each other, and allowing them to simmer for a few hours, when the mixture should be strained, cooled, and used as a gargle.

The following is equally serviceable:

℞—Potassii chloratis		ʒj (4.0)
Fluidextracti rhois glabræ		f ℥ss (16.0)
Aquæ destillatæ	q. s. ad	f ℥iij (90.0).—M.

S.—To be added to an equal quantity of water in a glass and used as a gargle every two hours, after stirring.

This prescription makes an abominable-looking pharmaceutical preparation, but is an exceedingly useful one.

In *acute rectal catarrh* with *mucous diarrhea* and *tenesmus* a solution of chlorate of potassium in water, 20 grains (1.3) to the ounce (30.0), injected into the bowel, will often produce a cure after one or two injections. Not more than 4 ounces (120.0) should be used, and it ought to be retained for twenty minutes. Often it will be well to add the saturated watery solution of the chlorate to an equal quantity of starch-water, as the latter aids in allaying the local irritation. This same method can be used in the treatment of *hemorrhoids*, and a few drops of laudanum, if added to this solution, will be found of great service. The troches (*Trochisci Potassii Chloratis*, B. P.) are given in the dose of 1 to 6, each lozenge containing about 2½ grains (0.15). They are intended to be dissolved in the mouth to affect the oral mucous membrane, but if many are used they are apt to disorder the stomach and kidneys by reason of an excess of the drug being swallowed in the saliva.

POTASSIUM CITRATE.

Citrate of potassium (*Potassii Citras*, U. S. and B. P.) is almost neutral in reaction and very soluble in water. It is by far the most agreeable of all the salts of potassium to the taste. In the early stages of *bronchitis* it is of the greatest value when combined with ipecac (see Bronchitis), and it is also useful as an alkaline diuretic. In bronchitis the dose should be 20 grains (1.3) every four hours, and in *urinary incontinence* due to acid and concentrated urine the dose should be equally large.

Under the name of Neutral Mixture (*Mistura Potassii Citratis*), made by adding to 1 pint (480 cc.) of lemon-juice enough bicarbonate of potassium to neutralize it, we have a useful febrifuge drink in *fevers*, particularly those of childhood. The dose is ½ to 1 ounce (16.0–30.0) every few hours.

Liquor Potassii Citratis, U. S., is made in the same manner as is the neutral mixture, except that citric acid is substituted for the lemon-juice (citric acid 6 grams, potassium bicarbonate 8 grams, and water 100 cc.

The neutral mixture is the better preparation of the two, but more expensive. A very refreshing and agreeable way of prescribing this drug is in the form of "effervescing draught," made by mixing two solutions which are prepared as follows: (1) Lemon-juice and water, equal parts, enough to make 4 ounces (120 cc.). (2) Bicarbonate of potassium 1 dram (4.0) and water 3 ounces (90.0). These solutions are to be mixed in the quantities desired, and taken while effervescing. If lemon-juice is not at hand, a solution of citric acid of the strength of 2 drams (8.0) to 4 ounces (120.0) of water should be employed in its stead.

Under the name of *Potassii Citras Effervescens* the U. S. P. of 1900 calls for an official powder possessing the advantages of the mixture just named.

POTASSIUM CYANIDE.

Cyanide of potassium (no longer official) is used in the same way and for the same purpose as hydrocyanic acid. (See Hydrocyanic Acid.) The dose is $\frac{1}{12}$ to $\frac{1}{10}$ grain (0.006).

The following prescriptions may be used in cases suffering from *bronchitis* or *phthisis* accompanied with excessive cough:

℞—Potassii cyanidi . . . . gr. ij (0.12)
Morphinæ sulphatis . . . . gr. j (0.06)
Syrupi pruni virginianæ . . . . . . q. s. ad f℥iij (90.0).—M.
S.—Teaspoonful (4.0) three to five times a day.

Or as follows:

℞—Potassii cyanidi . . . . gr. ij (0.12)
Ammonii chloridi . . . . ʒij (8.0)
Elixir calisayæ . . . . q. s. ad f℥iij (90.0).—M.
S.—Teaspoonful (4.0) three or four times a day. I do not recommend it.

POTASSIUM HYDROXIDE.

Potassium hydroxide (*Potassii Hydroxidum; Potassa Caustica,* B. P.) is a hard white solid, which readily deliquesces; it possesses great caustic power, and has been used in medicine for the purpose of burning away *growths or exuberant ulcers.* In small *cutaneous cancers* it is applied to the spot for a minute or two after the protecting scab is removed. The parts are then poulticed for several days, when the slough comes away. A piece of the drug placed on the skin by means of a pair of forceps will at once soften and burn the tissues for some distance. The surrounding skin should be protected by wax, suet, or oils, and a piece of adhesive plaster, with a hole for the growth, should first be applied to prevent action on the surrounding healthy tissues. The burn produced by caustic potash is very painful, and cauterization through its influence should not be practised if it can be avoided. When the caustic has acted sufficiently, it is to be washed off with vinegar or other dilute acid to neutralize it. It may be used in extracting a foreign body from under a nail by scraping the nail until it is very thin, then applying a 15 per cent solution to the spot until the nail is soft, washing the part with water. The object can then be grasped with forceps. Vienna paste (*Potassa cum Calce*) is used for the same purpose as is caustic potash.

POTASSIUM IODIDE.

(See Iodide of Potassium.)

POTASSIUM NITRATE.

Nitre (*Potassii Nitras,* U. S. and B. P.), or saltpetre, is next to the cyanide and chlorate of potassium, is the most poisonous of the potassium salts and produces, when taken in overdose, violent gastroenteritis. While it does not affect the blood, it is more irritant than the chlorate.

Nitrate of potassium is rarely employed at present, and has been very properly put aside as inferior to the harmless vegetable potassium salts (the citrate, acetate, and bitartrate). If used in *rheumatism*, the dose should be 1 ounce (30.0) in 1 pint (480 cc.) of barley-water or syrup of acacia and water, to be taken in divided doses of a tablespoonful every three hours. Nitrate of potassium papers (*Charta Potassii Nitratis*) are made by dipping unsized paper in a solution of the drug of the strength of 20 parts of the salt to 80 parts of distilled water. They are rolled into cigarettes and smoked by *asthmatics*, or burned in a pan and the fumes arising from them inhaled. Their efficacy may be increased in cases where the respiratory mucous membrane is irritable by dipping them in compound tincture of benzoin and exposing to the air long enough to dry. They should then be protected from the air until used. The paper used should be moderately thin bibulous paper.

POTASSIUM PERMANGANATE.

Potassii Permanganas, U. S. and B. P., is a salt of a dark purplish-red color, appearing in small crystals and readily soluble in water. In the presence of moisture it rapidly gives up the oxygen which it contains and becomes the dioxide of manganese.

By reason of its oxidizing power the permanganate of potassium is useful as an antiseptic and deodorant. It should not be employed as a disinfectant for filth, because its action is too fleeting, but in saturated solution, followed by 8 per cent of oxalic acid solution, it proves itself one of the best disinfectants for the hands in surgical practice. (See Antisepsis and Disinfection.)

Permanganate of potassium is given in the same dose for *amenorrhea* as the dioxide of manganese, but is much less efficacious. It is also very apt to irritate the stomach.

The permanganate is the most efficient chemical antidote to *snake venom* if placed in the wound before the poison is absorbed. It should also be injected hypodermically all about the seat of the bite. Permanganate of potassium is the best chemical antidote in *poisoning by morphine* and in that caused by many other vegetable alkaloids. It is also a good chemical antidote in *phosphorus poisoning*. For the relief of the *dermatitis* of poison ivy a 3 per cent solution may be applied and the inevitable stain may be removed later by a 1 per cent solution of oxalic acid. In large doses it is efficient in *cholera*. (See Cholera.) Owing to its rapid evolution of oxygen it acts as an antiseptic, and may be used to wash *wounds, ulcers*, and *sores*, and as a lotion in the form of a gargle or on a swab in the sore-throat of *diphtheria* and *scarlet fever*. The solution used should be from 2 to 6 grains (1.3-4.0) to the pint (480 cc.); the former is used on mucous membranes, the latter for sores and wounds. In *fetid rhinitis* and *otitis media* permanganate solution is useful as a wash in the proportion of 1 grain (0.06) to the ounce (30.0). In the proportion of 30 grains (2.0) to the pint (500.0) it makes an efficient douche for *fetid vaginal discharge.* When given in solution permanganate of potassium should be dissolved in distilled water, *and it should never be mixed in a mortar with any organic matter, as it will explode.* A solution (*Liquor Potassii Permanganatis*) is official in the B. P.

PROCAINE.

Procainæ Hydrochloridum, U. S., German name Novocaine, is a synthetic chemical, being the hydrochloride of para-amino-benzoyl-diethylamino-ethanol. It is a colorless crystalline substance, soluble in equal parts of water and is not damaged by boiling.

Physiological Action.—Procaine paralyzes peripheral sensory nerves as does cocaine, but is not so irritant, although its benumbing effects are as marked as that drug. Applied to a mucous membrane it is not as penetrating as cocaine. Experiments on animals indicate that it is about one-seventh as toxic as cocaine and one-third as toxic as eucaine. Much depends upon its rate of absorption, for if absorbed slowly the liver rapidly destroys it. Dropped into the eye it does not cause mydriasis, nor does it constrict the capillaries as does cocaine. This is a disadvantage when used in the nose, in many cases.

Therapeutics.—The sole use of procaine is to produce anesthesia either by topical application, infiltration or by spinal anesthesia. For infiltration anesthesia, where large areas are to be affected, a $\frac{1}{4}$ of 1 per cent (0.25) may be employed. For intraspinal anesthesia 2 to 3 cc. of a 5 per cent solution is to be used, combined, as a rule, with adrenalin or the synthetic product, suprarenin. At present a very large number of surgeons use procaine with adrenalin, with or without preceding it with nitrous oxide and oxygen, for the induction of anesthesia not only in minor surgery but in the most radical major operations, inducing the local anesthesia by pushing the needle attached to a syringe charged with the drug ahead of the knife. It has practically supplanted cocaine for these purposes. In the eye the strength of the solution varies from 1 to 10 per cent. When used in the nose the solution is usually of the strength of 5 per cent, but much weaker solutions are often efficient, and when employed in the throat the solution may be 10 per cent. When used as an anesthetic to the gastric mucosa the dose is said to be from 2 to 7 grains (0.01–0.5). The best way to prepare solutions is to use it in the tablets of procaine and sodium chloride found on the market.

Untoward Effects.—Procaine is capable, particularly in those who have an idiosyncrasy to its influence, of causing a tendency to collapse and in other instances serious respiratory difficulty followed by clonic convulsions. A number of deaths have been reported as due to this drug. If the blood-pressure is low the drug should not be employed, or only with great caution. The symptoms may not appear for an hour after its use. These untoward effects are apparently prevented by the use of 5 or 10 grains (0.3–0.65) of barbital given some hours before procaine is used, and if convulsions develop. the same dose of sodium barbital should be given intravenously dissolved in 15 cc. of water.

Procaine sometimes causes dermatitis. This can be relieved by thoroughly washing the skin with a weak boric acid solution followed by application of cold cream. (See Aluminum Acetate.)

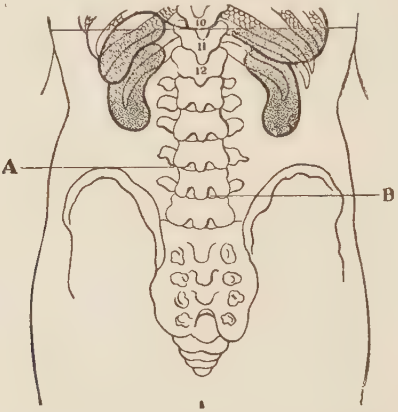


Fig. 62.—*A*, space between the third and fourth lumbar vertebræ for subarachnoidean injection (Quincke's area); *B*, area of puncture suggested by Tuffier.

The method of inducing spinal anesthesia is as follows: If the patient is strong he sits on the edge of the operating table, with his feet on a chair and with his body bent forward as far as possible to separate the intervertebral spaces. If the patient is too feeble to sit up, or there are other reasons for the prone posture, he lies on his side with the head flexed and the knees drawn up as far as possible. The skin from the first to the last lumbar vertebra is sterilized with tincture of iodine, and it may be anesthetized by Schleich's infiltration method. (See Cocaine.) A strong hollow needle, reinforced by a stylet in some cases, is then introduced a little to one side of the middle line at different levels according to the area it is desired to anesthetize, but never above the tenth dorsal interspace, as there is danger of injuring the cord. It usually enters the subarachnoid space at a depth of 4 to 6 cm., according to the size of the patient. When introduced in the lumbar region the direction of the needle is almost at a right angle to the plane of the back, but directed slightly upward. In the dorsal region this upward tendency is increased so as to conform to the overlapping of the spinous processes. If the puncture is successful on withdrawing the stylet, cerebrospinal fluid escapes from the needle in drops or jets. If the tap is dry the needle may be plugged by tissue, it may have failed to enter the space, or it may have been carried across the space and be embedded on the other side. The re-introduction of the stylet may remedy the first fault, pushing the needle farther may correct the second difficulty or, withdrawing it, may disengage the tip from the tissues on the far side from the puncture. If these moves fail another puncture must be made. If the needle is dripping fluid a syringe is attached to it, and a little cerebrospinal fluid is sucked into it to warm the syringe and to dilute the contents of the procaine solution which has been drawn up into the syringe. The injection should be slowly made. When the area to be anesthetized is that of the lower limbs and trunk up to the navel the injection is made at the third or fourth lumbar level, and this area can be increased to the nipple by tilting the body so that the fluid is diffused upward. When the upper abdominal area is to be anesthetized the tenth or eleventh dorsal space is selected. A good localizing point is made by drawing a line across the back from the iliac crests. This corresponds to the space between the third and fourth lumbar vertebræ. Within a few moments the legs feel asleep and numb and the patient is ready for operation almost at once. The site of operation is shut off from vision by a hanging sheet.

As well emphasized by Sise spinal anesthesia is not to be resorted to without good reason and with everything at hand to combat collapse if it threatens. It is not wise to wait for actual collapse. A drop of 20 to 30 points in blood-pressure is a danger signal. The higher the injection and the higher the flow of fluid by reason of posture the greater the danger. A warm saline solution with an injection apparatus should always be ready, and adrenalin is essential, given in the solution or injected into it by puncturing the rubber tubing by means of a strong needle and syringe. Not more than 5 to 10 minims of the 1 to 1000 solution is needful. It may be given intramuscularly if the condition is not very urgent. Putting the patient in the Trendelenburg posture to supply the medulla with blood may do good, but on the other hand carries more of the drug to that area.

It is worthy of note that the very conditions that at first glance indicate spinal anesthesia also contraindicate it, for these are shock, sepsis, hemorrhage, old age if feeble, or, indeed, feebleness and low vitality from any acute or chronic cause. If the patient is dehydrated it is well to give beforehand 500 to 1000 cc. of normal saline by hypodermoclysis.

If the patient is very apprehensive a hypodermic injection of scopolamine and morphine may be given before the puncture is made. Severe headache lasting for days is the most common untoward effect. Vomiting seems to occur in about 7 per cent of cases. Age does not seem to contraindicate the method at either extreme of life. It is wise to do another puncture and remove some of the procaine if symptoms which are alarming develop. Some clinicians think it is not contraindicated as strongly as ether or chloroform when the heart, lungs, or kidneys are diseased or when diabetes is present. On the other hand, some of those who are most enthusiastic in their use of this method, emphasize the fact that great care must be used in the selection of cases and that hypotension, particularly if the systolic pressure is below 100 are poor risks. The patient should rest in bed for several days after the injection.

Notwithstanding the claims of its advocates, spinal anesthesia has a limited range of usefulness. It is statistically more dangerous than chloroform, for in 15,842 cases collected by Strauss there were 21 deaths, or 1 in 754. Miller states that in 35,062 cases there were 68 deaths or 1 in 515. These statistics represent all the drugs so used, not procaine alone, which latter is safer than others. The method is to be used in certain peculiar cases, but not as a general procedure.

Sacral anesthesia is a term applied to the method of relieving pain by benumbing the sacral nerves with a local anesthetic. Presacral anesthesia is obtained by injection of such a solution on the anterior surface of the sacrum, and transacral anesthesia consists in making the injection through the posterior sacral foramina to reach those nerves. Caudal anesthesia consists in injecting the fluid into the sacral canal through the hiatus sacralis outside the dura. Special study is needed for the successful use of sacral anesthesia. (See books on local anesthesia.) Caudal anesthesia is far safer than spinal anesthesia because the fluid injected enters below the subarachnoid space and so cannot flow upward toward the medulla. The patient lies prone with a pillow under the pelvis. The tip of the sacrum is felt with the finger which is slipped up until the sacral hiatus is felt. The needle is then introduced and resistance can be readily felt as it perforates the sacro-coccygeal membrane. If blood or cerebrospinal fluid escape the needle must be withdrawn. If not from 15 to 20 cc. of a 1 per cent solution of procaine is injected. This method is used in operations on the prostate and rectum and in some cases when the cystoscope is to be employed. Sacral and caudal anesthesia is resorted to for the performance of operations on the prostate and rectum when the condition of the patient is such that a general anesthetic is deemed to be unwise.

In many instances morphine and scopolamine are used by hypodermic injection before intraspinal injection is performed.

PROTARGOL.

Protargol is a silver preparation containing 8.3 per cent of silver, and occurs as a yellowish powder readily dissolved in cold and hot water, forming a clear solution. It is employed in *gonorrhea* and in *gonorrheal conjunctivitis*, because it is destructive to the gonococcus. (See Conjunctivitis.) It is not precipitated on contact with albumin or alkalies, nor by dilute hydrochloric acid. It therefore has distinct advantages over nitrate of silver. A 1 to 5 per cent solution of protargol is the strength ordinarily used in the treatment of gonorrhea, and these solutions may also be employed in the eye. (See Conjunctivitis.) If used on a camel's-hair brush or swab, the solution may be as strong as 5 per cent; but if the drug is used as a collyrium its strength should not exceed 1 to 400 or 1 to 200.

PRUNUS VIRGINIANA.

Prunus Virginiana, U. S., and *Pruni Virginianæ Cortex*, B. P.—wild cherry, as it is incorrectly called, contains a substance known as amygdalin, which when it comes in contact with water forms hydrocyanic acid through the action of another substance, known as emulsin.

Therapeutics.—Wild-cherry bark is largely used as a domestic tonic, and in the form of a syrup as a vehicle for *cough* mixtures.

It has been supposed that the hydrocyanic acid present allays the cough, but this is doubtful, as the acid is fleeting in its effect and is present in very small quantity.

Administration.—As a tonic prunus virginiana is used in the form of the infusion, dose ½ to 1 ounce (16.0–30.0), and the fluidextract, dose 30 minims to 1 dram (2.0–4.0). The syrup (*Syrupus Pruni Virginianæ*, U. S. and B. P.) is given in the dose of 1 to 4 drams (4.0–16.0), ½ to 1 fluidram (2.0–4.0), B. P. The B. P. also contains a tincture (*Tinctura Pruni Virginianæ*), given in the dose of ½ to 1 dram (2.0–4.0).

PYOKTANIN.

(See METHYL BLUE.)

PYROGALLOL.

Pyrogallol, U. S., sometimes called pyrogallic acid, is used in *parasitic skin diseases*, in ointment, in the strength of 30 to 100 grains (2.0–6.6) to the ounce (30.0). The stronger ointments exercise a mild caustic effect. It may be employed in place of chrysarobin in *psoriasis*. It stains the skin a deep brown.

QUASSIA.

Quassia, U. S. (*Quassiæ Lignum*, B. P.) is the wood of *Picrasma excelsæ*. It is also derived from *Quassia amara*. It contains an active principle, named quassin, which is intensely bitter and an irritant to mucous membranes.

Quassia is a simple bitter tonic which has been used very largely in domestic medicine and by the medical profession. It is very efficient as a tonic, is supposed to be particularly useful in the *anorexia* following malarial fevers, and has even been thought to possess antiperiodic power. In *simple dyspepsia* with *eructations* after meals, due to gastric inactivity, it is very serviceable.

In the treatment of *seat-worms* (*Oxyuris vermicularis*), or *thread-worms*, as they are often called, injections of the infusion of quassia are the most efficacious and useful remedial measures we possess, and yet are harmless to the patient. The bowel should be well washed out with soap and water, and ½ pint to 1 pint of an infusion, made by adding 1 to 2 ounces (30.0–60.0) of quassia chips to 1 pint (480 cc.) of water, should be injected and retained for some minutes. A few such injections will invariably kill the parasites, provided the bowel is first well washed out with soap and water and enough fluid is injected to reach high up into the rectum.

Administration.—The tincture (*Tinctura Quassiæ*, N. F. and B. P.) is given in the dose of ½ to 1 dram (2.0-4.0), the fluidextract ½ dram (2.0), and solid extract 1 to 3 grains (0.06–0.2). The infusion (*Infusum Quassiæ*, B. P.) is given in the dose of ½ to 1 ounce (16.0–30.0), and is made by macerating 10 grams of quassia with 1000 cc. of water, and allowing it to stand fifteen minutes or more.

QUERCUS.

Quercus, or white oak, in infusion made from the crude drug 1 ounce (30.0) to 1 pint (480 cc.), or by adding the fluidextract to water, is used as an astringent injection in *gonorrhea* and *vaginitis* in women, where a large amount of fluid is necessarily employed. It is also used in *prolapse of the rectum*, in *hemorrhoids*, in *leucorrhea*, and as a gargle in *sore-throat*. It stains the clothing very slightly.

Quercus Tinctoria is equally efficient, but is seldom used because it stains the clothing. In the form of the powdered bark it was at one time used as an astringent poultice to freely *running sores*, to check the discharge.

RESIN, OR ROSIN.

Resina, U. S. and B. P., is resin or rosin, the mass left after the distillation of turpentine, and enters largely into plasters, cerates, and similar preparations. Its fumes when it is burnt are said to be of value when inhaled in cases of *chronic bronchitis*. *Ceratum Resinæ*, U. S., is used in *chilblains* and *superficial scalds*. *Ceratum Resinæ Compositum*, U. S., popularly known as Deshler's Salve, is used as a stimulating application. *Unguentum Resinæ* is a B. P. preparation, and is used for the same purposes as the cerate.

RESORCINOL.

Resorcinol, U. S., and *Resorcinum*, B. P (metadioxybenzol), is the *meta*-compound of the group of which hydrochinone is the *para*- and pyrocatechin the *ortho*-, and occurs in clear crystals of a slightly reddish hue. It is quite soluble in water, alcohol, and ether.

Physiological Action.—Resorcinol is an irritant to mucous membranes, and when taken internally in poisonous doses causes deafness, giddiness, salivation, profuse sweat, unconsciousness, and clonic convulsions. The heart of the dog under its influence is at first slowed by vagal stimulation, and then becomes very rapid in its action from vagal palsy.

Therapeutics.—Resorcinol has been found of service as a remedy for *whooping cough*, given in the dose of 10 minims (0.6) of a 2 per cent solution or used in a spray of the same strength, the latter being the better method of using the drug.

Resorcinol has also been employed in a spray in 2 per cent solution in *hay fever* with remarkably good effects. It has been used as an antipyretic, but is not serviceable and has little power over fevers.

The chief use of resorcinol is in skin affections of a subacute or chronic character, such as *eczema* with much induration, and in *psoriasis*. In these states an ointment of the following character, well applied, is of service:

℞—Resorcinolis	ʒj (4.0)
Zinci oxidi	ʒj (4.0)
Unguenti aquæ rosæ	ʒx (40.0).—M.

S.—Apply twice a day to the part affected.

After mixing the ointment heat it until the resorcinol crystals melt, to prevent any irritation of the skin.

Resorcinol is also of service in weak solution in allaying itching of the skin due to *erythematous eczema*. For this purpose it should be used in watery solutions of about 10 or 15 grains to the ounce, and a little salt added to aid in its absorption by the skin. This should be dabbed, not rubbed, on the part:

℞—Resorcinolis	gr. xv (1.0)
Glycerini	♏x (0.6)
Liquoris calcis	f℥j (30.0).—M.

In the slowly spreading *epithelioma of the face* the following plaster, recommended by Hartzell, is useful:

℞—Resorcinolis	gr. lxxij (5.0)
Ceræ flavi et pulveris resinæ	ʒiss (6.0)
Olei olivæ	q. s.—M.

Another valuable use of resorcinol is in the treatment of *seborrhea capitis* of the dry, scaly type:

℞—Resorcinolis	ʒj (4.0)
Olei ricini	♏xxx (2.0)
Alcoholis	f℥ij (60.0)
Spiritus myrciæ	q. s. f℥iv (120.0).—M.

S.—Use as a lotion to the scalp, after washing with castile soap and water, once a day.

Within the last few years resorcinol has been employed with good results in the treatment of *gastric ulcer* in the dose of 2 to 4 grains (0.12–0.25) before each meal in pill or capsule. It is supposed to act by reason of its analgesic, antiseptic, and hemostatic power.

RHAMNUS PURSHIANA.

(See CASCARA SAGRADA.)

RHUBARB.

Rheum, U. S. (*Rhei Rhizoma*, B. P.) is the root of several species of *Rheum*. Several principles are contained in it, all of which are unimportant and never used alone, except chrysophanic acid.

Physiological Action.—According to the studies of Prevost and Binet, rhubarb acts inconstantly upon the flow of bile, sometimes increasing it, sometimes having no effect; but, on the other hand, according to those of Rutherford and Vignal, it never fails to stimulate biliary secretion. Owing to the astringent properties possessed by rhubarb, it does not purge excessively, and improves the appetite, digestion, and intestinal tone. Its constant use produces chronic constipation.

Therapeutics.—Whenever it is desired simply to *unload the bowels* without affecting the general system rhubarb may be employed. With equal parts of castor oil it is very effective. In children a state is very commonly seen in which *constipation* is replaced by diarrhea if any ordinary laxative is employed, and in these instances rhubarb is the best remedy, as it is astringent and prevents any after-effects other than those directly produced by the dose. In the *summer diarrhea* of children, when the stools are green, rhubarb is often used to empty the bowels of fermentative products before direct treatment is instituted.

Rhubarb, because of its chrysophan, may stain alkaline urine carmine or acid urine yellow.

Administration.—The preparations of rhubarb are unnecessarily numerous. Rhubarb itself may be given in the dose of 20 grains (1.3) in powder, and small pieces of the root are habitually chewed by some persons for the relief of constipation. *Extractum Rhei*, U. S. and B. P., is given in the dose of 5 to 10 grains (0.3–0.6) in pills. *Pilulæ Rhei*, U. S., of which each pill contains 3 grains (0.2) of rhubarb, is given in the dose of 1 to 3 pills; and *Pilulæ Rhei Compositæ*, N. F., and *Composita*, B. P., which contain 2 grains (0.12) of rhubarb and 1½ (0.09) of aloes, are given in the same dose. *Pulvis Rhei Compositus*, U. S. and B. P., contains rhubarb, magnesium oxide, and ginger, and is given in the dose of 20 to 40 grains (1.3–2.6); *Fluidextractum Rhei*, U. S., is given in the dose of 20 to 30 minims (1.3–2.0). *Syrupus Rhei*, U. S. and B. P., is given in the dose of 1 dram (4.0) to a babe, and 4 drams (16.0) to an adult, although rarely used for older persons. *Syrupus Rhei Aromaticus,* U. S., is given in the same dose and to the same class of cases. *Tinctura Rhei,* U. S., is used in the dose of ½ to 2 drams (2.0–4.0), *Tinctura Rhei Aromatica,* U. S., *Tinctura Rhei Composita,* B. P., is used in the dose of ½ to 1 dram (2.0–4.0), and *Tinctura Rhei Dulcis,* U. S., 2 to 3 drams (8.0–12.0). The aromatic syrup is commonly employed for children, and the compound pills for adults. *Infusum Rhei,* B. P., is given in the dose of 1 to 2 ounces (30.0–60.0).

RHUS GLABRA.

Rhus Glabra, U. S., smooth sumac, is the fruit of *Rhus glabra,* and contains tannic and malic acids as its chief constituents of medicinal value. In the fluidextract *Fluidextractum Rhois Glabræ,* U. S., we have a preparation which is very efficient as a gargle for *sore-throat* when diluted with glycerin and water or prepared according to the formula given under Potassium Chlorate.

ROCHELLE SALT.

Potassii et Sodii Tartras, U. S. (*Soda Tartarata,* B. P.), is largely used as a saline cathartic in the dose of ½ ounce (16.0), and is preferred by many patients to Epsom salt because its taste is not so disagreeable. It is, however, more irritating. Rochelle salt is the purgative constituent of Seidlitz powder.

ROSA.

Rosa, U. S. (*Rosæ Gallica Retala,* B. P.), red rose, contains gallic and tannic acids, and is astringent. From it are prepared the *Fluidextractum Rosæ,* U. S., dose 5 drops to 2 drams (0.3–8.0), used to flavor other extracts, and the *Confectio Rosæ,* U. S., and *Confectio Rosæ Gallicæ,* B. P., which are used as bases for pills. *Mel Rosæ,* U. S., or honey of rose, is employed as a local application or as vehicle for gargles, and the *Syrupus Rosæ,* U. S. and B. P., dose 1 to 2 drams (4.0–8.0), as a flavoring substance. The acid infusion (*Infusum Rosæ Acidum,* B. P.) is given in the dose of ½ to 1 fluidounce (15.0–30.0).

Aqua Rosæ, U. S. and B. P., is used as a diluent or solvent for preparations, such as astringents, which are to be employed locally, as in injections for *gonorrhea.* It may also be used internally for these purposes. *Unguentum Aquæ Rosæ,* U. S. and B. P., is "cold cream," and is largely used as an emollient application to *small burns, sores, cuts, scratches,* and *chapped hands* and *lips.* It is much improved if a little glycerin and benzoic acid are added to keep it sweet in warm weather.

RUBUS IDÆUS, OR RASPBERRY.

Rubus Idæus, or raspberry, is used for the preparation of a syrup (*Syrupus Rubi Idœi*), which is employed very largely as an elegant vehicle or flavoring mixture. The leaves are often used in domestic medicine in a decoction or infusion for the cure of *diarrhea* when an astringent is needed.

SACCHARIN.

Saccharin (*Glusidum Solubile,* U. S., and *Glusidum,* B. P.) has an intensely sweet taste even in dilute solutions. It is soluble in 290 parts of water. This compound was first prepared by Fahlberg, under the direction of Professor Remsen. It is a remarkably sweet substance, two hundred and twenty times stronger than sugar in sweetening power. It is used largely to sweeten glucose and in confections. Saccharin escapes from the body unchanged, and is used in place of sugar to sweeten coffee, food, or medicine in cases of *diabetes* and *gout.*

The dose is indefinite, but it is to be noted that a very few grains will sweeten a large bulk of material. As 1 grain (0.06) is equivalent to about 1 tablespoonful (4.0) of sugar, less than 1 grain is the quantity usually given. It is commonly sold in small tablets containing ½ grain each (0.03).

Physiological Action.—Upon the circulation and similar vital functions saccharin has no effect, but Plügge has proved it to retard the action of all the digestive ferments, and to be in consequence not devoid of evil effect on diabetics whose digestion is impaired. Nevertheless the general idea that it is harmful in ordinary amounts is incorrect.

SALICIN.

Salicin (*Salicinum,* U. S. and B. P.) is a glucoside derived from several species of Salix and Populus. In other words, it is obtained from willow-bark. Salicin is highly thought of by many practitioners as a substitute for salicylic acid in the treatment of *acute articular* and *muscular rheumatism.* The dose is from 5 to 40 grains (0.3–2.6) every four hours, and it is best given in capsule or cachet, and washed down with a draught of water or milk after food has been taken.

SALICYLATE OF ETHYL.

Ethyl salicylate, sometimes called "Sal Ethyl" (*Æthylis Salicylas*), has the same action as the other salicylates, but is said to be less prone to produce disagreeable effects. It occurs as a colorless, volatile liquid, of pleasant aromatic taste, and is given in capsules in the dose of 5 to 10 minims (0.3–0.6 cc.), as may be indicated.

SALICYLATE OF METHYL.

(See GAULTHERIA.)

SALICYLATE OF SODIUM.

Salicylate of sodium (*Sodii Salicylas*, U. S. and B. P.) is a less irritant and somewhat less disagreeable preparation than salicylic acid. Its internal action, use, and doses are the same as those of the acid. It may be given by dissolving it in milk, and then adding rennet to produce a curd, which disguises the taste and protects the stomach. It is very soluble in water.

Salicylate of sodium in doses of 10 to 15 grains (0.65–1.0) is often most useful in subacute and chronic arthritis when given intravenously. For this purpose the drug put up in ready-made ampoules is to be preferred.

Other salicylates are largely used by some practitioners. Salicylate of lithium is supposed by some physicians to be of more value than the other salts. (See Acetyl-salicylic Acid, Strontium and Salophen.)

SALICYLIC ACID.

Salicylic acid (*Acidum Salicylicum*, U. S. and B. P.) occurs in fine white crystals or in fine white powder. It has a sweet yet acrid taste, and is derived from carbolic acid by treating it with caustic soda and carbonic acid at a moderate heat. Sometimes it is derived from plants in which it exists in combination, although the artificial acid is chiefly used. If the crystals are pinkish in hue, the acid should not be used, as it is probably impure.

Physiological Action.—On mucous membranes salicylic acid acts as an irritant. (See Poisoning.) One of its salts such as salicylate of sodium should always be used in its place when the drug is used internally.

NERVOUS SYSTEM.—Upon the nervous system salicylic acid exerts a slight sedative influence when given in medicinal doses, and causes buzzing in the ears and decrease of the reflexes. In poisonous doses epileptiform convulsions are produced by an action on the brain.

CIRCULATION.—Upon the circulation the effects of salicylic acid are not very marked in medicinal dose. It undoubtedly has a depressant rather than a stimulant effect, but the depression is very slight. It is sufficient, however, to make the use of the drug in massive doses in cases of feeble circulation worthy of thought and care.

RESPIRATION.—Medicinally it does not affect this function.

TEMPERATURE.—The effect of salicylic acid on temperature has been studied by the author with a good deal of care. The drug acts as a distinct antipyretic upon fevered states, and is a slight depressant of normal bodily heat. The studies of Gedl, Fürbringer, and Sée also show this, and those of Danewsky point to it. In the experiments of North upon man, after and during exercise, the antipyretic effects were marked. According to the author's studies, the drug lowers fever by diminishing heat production and increasing heat dissipation, but this is by no means positively decided as a fact.

ABSORPTION AND ELIMINATION.—Salicylic acid is absorbed from the stomach as a salicylate of sodium, and so circulates in the blood. It is eliminated by the kidneys and by all the secretions. In the urine it appears as salicyluric acid. According to Kolbe, after a dose of 1 ounce (30.0) elimination does not commence for three hours, but Fleischer found the drug in the urine in one and a half hours. Usually, however, it is far more rapidly eliminated, and, as pointed out by Soullier, after a dose of 15 grains (1.0) it appears in the urine in ten to twenty minutes and after 30 grains (2.0) in five minutes. The elimination continues for a period of from thirty-three to fifty-six hours (Weill). The urine after very large doses is dark olive-green, and this change in color is due to the presence of indican and pyrocatechin, which are formed by the action of the pancreatic juices upon the drug in the intestine. The presence of salicyluric acid in the urine is to be discovered by the addition of a solution of the chloride of iron to that fluid, which causes the appearance of a violet color. Stockman has shown that salicyluric acid is inert, so the drug probably acts as salicylate of sodium.

The increase in the elimination of uric acid when salicylic acid is given is not due so much to an increase in the excretion of acid already formed, as it is due to increased metabolism or tissue change produced by the drug. That the drug does not increase the elimination of the uric acid already deposited in the tissues is also proved by the fact that the salicylic acid and not salicyluric acid is often found in the kidney.

Poisoning.—Salicylic acid when taken in excessive dose causes profuse sweating, roaring in the ears, dimness of vision, headache, partial or total deafness, and a decided fall in temperature. The pulse becomes weak and relaxed, and finally ptosis, strabismus, and general paralysis ensue. The urine and feces are passed involuntarily, and the urine is olive green in color. The respirations at first are quickened and deepened, but finally become shallow and feeble, death ensuing from respiratory failure. Sometimes acetonuria is marked and the symptoms are those of so-called acetonemia.

If the dose is sufficiently large, the blood is involved and the corpuscles rapidly break down.

Therapeutics.—Salicylic acid, owing to its close resemblance to quinine, was first introduced as an antiperiodic and antipyretic, but soon was found to be of inferior value in these states and of superlative value in *acute articular rheumatism*, in which disease it was at one time supposed to destroy the specific microörganism. This is doubtful.

At present it is rarely if ever used for either of the former purposes, but is largely employed as a standard remedy for the latter disease. (See Rheumatism.)

The value of salicylic acid in rheumatism limits itself solely to the relief of pain and the cure of the malady without preventing the complications incident to its course. That is to say, the changes in the joints or heart in rheumatism are only of less frequency after the use of salicylic acid because the drug shortens the disease, and not because it prevents these changes by a direct influence; this is also true of *rheumatic hyperpyrexia,* where salicylic acid is of service in shortening the attack, though it often fails to control the temperature to any great extent. In *acute rheumatism* 15 to 20 grains (1.0-1.3) should be given every four hours until marked physiological symptoms occur, but some physicians believe in the use of twice this quantity. When the salicylates are given it is wise to give an equal quantity or more of sodium bicarbonate to prevent irritation of the stomach and because clinical experience has shown that this combination acts better for the cure of the disease than the salicylates alone. When larger doses are used the sodium bicarbonate tends to prevent the development of coma associated with acetonuria. Another method is to give 30 or 40 grains at 5 and 7 P.M., with a copious draught of milk, so that the main effects will be produced during sleep. If a cure does take place, relapses are very common indeed, and the drug should always be continued for many days after all symptoms cease. If the use of full doses of the salicylates fail to produce results after four or five days the probabilities are that the case is not one of true rheumatic fever but an arthritis due to another infection. The tonsils, teeth, and genito-urinary tract should be carefully looked into as a focus of infection. (See Rheumatism.) When chorea is associated with rheumatism it is a better drug than arsenic.

In *gonorrheal rheumatism* salicylic acid is of no value, for it has no influence upon the gonococcus in the joints. In *rheumatoid arthritis* it is valueless except to possibly relieve pain.

The question as to the value of the salicylates in cases of *gout* is one open for debate. Some physicians regard it as useful, others as useless. Thus Duckworth stated that in his experience and that of his friends the salicylates do not compare with colchicum. On the other hand, Sée, Jaccound, and Haig found them useful. If they are of any value, it is only when the dose is very large, and even then their usefulness seems to be doubtful. In that systemic state sometimes called "lithemic" the salicylates are useful. In *subacute rheumatism* citrate or acetate of potassium may be used in place of salicylic acid in the dose of 30 to 60 grains (2.0–4.0), these salts being taken just before going to bed.

In *lumbago, sciatica,* and similar states salicylic acid is a very useful remedy. While it is not so good as phenacetin in *neuralgia,* it is of great service in the *migraine* of rheumatic persons, often curing the attack. (See article on Migraine.)

Brunton has highly recommended the use of the salicylates with the bromides in the *nervous irritability* of gouty or lithemic persons.

Salicylic acid has been largely used for the removal of pleural effusion if the effusion be serous. Dock believes that the duration of treatment is less with the salicylates than by the use of diuretics, alteratives, or purgatives, but the author has not reached good results from this plan of treatment. The dose should be from 1 to 2 drams (4.0-8.0) daily. Doses larger than this are not necessary. How salicylic acid does good in pleural effusion is not known, as its diuretic properties are not sufficiently great to drain away the liquid by this means.

In *quinsy* or true *tonsillitis* the drug is thought by some practitioners to act as a specific, particularly when this condition is associated with a rheumatic tendency or goutiness. It will often prevent suppuration, shorten the attack, and relieve the pain and swelling. The doses should be small, say 3 grains (0.2) at each dose, and given hourly. In *stomatitis*, after the blisters have broken, the burning and pain are often intense, and a mouth-wash of salicylic acid in the proportion of 1 to 250 of water is useful.

Ringer recommended the use of the following salve in *pruritus* of the anus and vulva:

℞—Acidi salicylici	ʒij (8.0)
Olei theobromatis	ʒv (20.0)
Cetaceæ	ʒiij (12.0)
Olei myristicæ	fʒiss (6.0).—M.

In the treatment of *corns* there is probably no better application than lint soaked in a solution of salicylic acid, or the use of the following formula as a paint, which should be applied after soaking the foot in hot water:

℞—Acidi salicylici	gr. xxx (2.0)
Extracti cannabis	gr. v (0.3)
Collodii	f℥ss (16.0).—M.

S.—Apply with a brush until a good coat is formed.

After a few days the corn can be peeled off with ease.

A useful salve for the soreness following horseback or bicycle riding is one composed as follows:

℞—Acidi salicylici	gr. x (0.6)
Adipi benzoinatis	℥j (30.0).—M.

S.—Apply to the sore part.

A solution of salicylate of sodium or of bicarbonate of sodium, applied on lint to *inflamed rheumatic joints*, often gives great relief. Smearing an ointment of salicylic acid over the joints not only produces good effects locally, but by absorption of the drug influences the disease. (See Rheumatism, Part IV.)

In *gastric dilatation* or *catarrh*, where vomiting occurs and the matters vomited contain *sarcinæ*, salicylic acid will be found of service, as it acts as an antiseptic in the stomach. In adults suffering from *ascaris lumbricoides*, or *round-worms*, salicylic acid may be used in the dose of 8 grains (0.5) every hour until 40 grains (2.6) are taken. This treatment should be followed by the use of a purge. For thread- or seat-worms the following injection will be found of service:

℞—Acidi salicylici	ʒss (2.0)
Sodii boratis	ʒss (2.0)
Aquæ	Oj (480).—M.

S.—Warm, and inject into the bowels. For a child reduce this one-half in all its parts.

In *bromidrosis* of the feet (excessive sweating with fetor) salicylic acid may be dusted over the parts, or the following powder used:

℞—Acidi salicylici, Pulveris amyli	āā ℥ss (16.0).—M.

S.—Apply to the feet.

In *eczema* of the face and hands, where the eczema is of the wet or weeping variety, salicylic acid, locally applied, is often of great service.

℞—Acidi salicylici	gr. v vel x (0.3–0.6)
Pulveris amyli	ʒij (8.0)
Pulveris zinci oxidi	ʒij (8.0
Petrolati	℥ss (16.0).—M.

S.—Apply locally.

If the eczematous process is subacute and needs stimulation, the salicylic acid may be increased to 20 or 30 grains (1.3–2.0).

Antiseptic Use.—Salicylic acid is employed as an antiseptic in the treatment of *wounds* as a local remedy and as a dressing, but should not be applied over too large an area, as it may be absorbed and produce constitutional symptoms. As an application to *small burns* a mixture of 1 dram (4.0) of salicylic acid to 8 ounces (240.0) of olive oil is of service.

In the treatment of *soft chancres* and *venereal sores* salicylic acid has been largely used by some practitioners either as a salve or as a dusting powder, as follows:

℞—Acidi salicylici	gr. xx (1.3)
Alcoholis	gtt. xlv (3.0)
Adipis benzoinati	℥ij (60.0).—M.

Or,

℞—Acidi salicylici	gr. xv (1.0)
Pulveris amyli vel cretæ	ʒij (8.0).—M.

Salicylic acid may be added to urine to prevent its decomposition, but will sometimes cause the reactions for sugar to appear. Patients taking salicylic acid often notice that the urine is odorless after standing, and that it will remain fresh for many days because of the salicyluric acid present in it. The drug may cause, when taken internally, the reaction of sugar in the urine with Trommer's test.

Untoward Effects.—Salicylic acid, as already stated, may produce headache and roaring sounds in the ears. In persons with middle-ear disease it is contraindicated unless urgently called for, as it often makes the deafness permanently worse. Sometimes erythema or acne follows its employment, and blindness and retinal hemorrhages have occurred. Strümpell asserts that delirium of an active character sometimes appears after full doses of salicylic acid, which delirium is usually happy in its type, and is seen most commonly in young girls. Sometimes full doses produce visions which may be seen only when the eyelids are closed. When very large doses are given symptoms resembling diabetic coma may develop and acetonuria may become marked. The use of chloroform for anesthesia, when such doses of salicylic acid are being used, is probably more dangerous than usual. (See Chloroform.) It is impossible to enumerate all the untoward effects which have been noted, but it is worthy of remark that very few deaths have taken place.[1] Binz thinks that full doses of salicylic acid may produce abortion in women who already have a tendency to abort, and Vineberg thinks that menorrhagia and metrorrhagia are caused by it.

Contraindications to the use of the salicylates are meningeal inflammation or congestion, middle-ear disease, marked albuminuria, inactivity of the kidneys, particularly that occurring in pregnancy, and parenchymatous nephritis.

Administration.—Salicylic acid has a nauseous taste and is irritant to the stomach. It may be given in a solution of glycerin and compound tincture of cardamom or its taste may be masked by the use of syrup of bitter orange peel or syrup of ginger. The following formula may be used:

℞—Acidi salicylici	ʒij (8.0)
Tincturæ lavandulæ compositæ	f℥vj (180.0)
Glycerini	f℥ij (60.0)

S.—A tablespoonful (16.0) every four hours.

Salicylic acid is best given in capsule with a little sodium bicarbonate, but as it is irritant to the stomach in so concentrated a form, the capsule must be taken with water or milk, and should follow rather than precede meals. (See Sodium Salicylate.)

If buzzing in the ears produced by this acid is annoying, bromide of sodium in the dose of 20 grains (1.3) will generally give relief.

Salicylic acid ointment (*Unguentum Acidi Salicylici*, B. P.) is a useful preparation for external application in chronic, deep-seated skin diseases.

SALOL.

Phenylis Salicylas, U. S., *Salol*, B. P., is a white crystalline powder, faintly aromatic and almost without taste. It is not soluble in water, but is in alcohol, and an alcoholic solution forms an imperfect emulsion when mixed with water. Salol is also slightly soluble in copaiba, in the oils of sandalwood and of turpentine, and in mineral oils. This solubility is very useful in prescribing it with these remedies in certain diseases of the genito-urinary organs. (See Gonorrhea.)

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[1] See author's Boylston Prize Essay of Harvard University on Antipyretics.

Salol is a compound of 60 parts of salicylic acid and 40 of phenol, and is decomposed by the pancreatic juice into these two substances. For this reason overdoses are capable of producing symptoms of phenol poisoning. Thus 20 grains of salol (1.3) taken five times a day will cause a person to take 40 grains (2.6) of phenol, which is almost a poisonous dose.

Hesselbach has proved that large doses of salol are very apt to affect the kidneys unfavorably, and rightly believes it to be contraindicated in all cases of renal inflammation of an acute type.

It is worthy of note that the drug rarely produces untoward effects, although at one time a number of observers accused it of frequently doing so.

Salol is used for the same purposes as salicylic acid in the treatment of *rheumatism* when the stomach is so irritated that it cannot bear the latter drug, as salol is dissolved in the small intestine. A dose often used is 5 grains (0.3) an hour, but this is too much, as a rule, and may produce renal irritation. Salol is also useful in *muscular rheumatism* and *neuralgia* due to exposure. In *pharyngitis* 5 grains (0.3) of salol, given three times daily, is a valuable part of the treatment of the affection, and in persons subject to *chronic sore-throat* due to the lithemic diathesis this treatment will often produce excellent results. It is of the greatest use in *duodenal catarrh* and *catarrhal jaundice* to arrest intestinal fermentation.

In the treatment of *gonorrhea* in all its stages salol may be employed by the mouth, as in the elimination of its ingredients it acts as an antiseptic and tends to sterilize the urethra at each act of micturition. (See Gonorrhea.)

Salol is of value in *intestinal indigestion* and *fermentation*, and is sometimes used in cases of mild or *pernicious anemia* when it is thought that the development of decomposition products is their cause. (See Anemia.) In *diarrhea* dependent upon such causes salol is one of the best remedies we have, since it renders the intestinal canal antiseptic, and so removes the cause of the disorder, instead of locking the putrid material in the bowel, as does opium. In *cholera morbus* the following is very useful:

℞—Phenylis salicylatis		ʒj (4.0)
Bismuth subnitratis		ʒij (8.0)
Misturæ cretæ	q. s. ad	f℥iij (90.0).—M.

S.—Two teaspoonfuls (8.0) every two hours. Shake well.

Wide experience with the drug in the treatment of *cholera* during epidemics has proved it to be one of the best remedies that can be employed in the treatment of this disease.

Salol may be given in wafers, capsules, or pills, in the dose of 5 grains (0.3) or more.

It should be borne in mind that no dose of salol can be given which will act as an intestinal germicide, because as soon as it is dissolved in small intestines the salicylic acid and the phenol are absorbed.

SALOPHEN.

Salophen (*Salophenum*) has been introduced as a substitute for salol, and is said to possess the advantage of being far less poisonous than salol, because in this case the phenol of the salol is replaced by a compound of phenol, which is innocuous. Experiments on animals seem to indicate that these theoretical advantages are present in fact. Salophen is broken up in the intestine by the juices there present, and the result is salicylic acid and acetylparamidophenol. Salophen contains about 10 per cent less salicylic acid than does salol (51 per cent).

Therapeutics.—For the therapeutics of salophen the reader is referred to the article on Salol, as the indications for both drugs are identical, save the salophen can probably be used when salol cannot be employed. The dose of salophen is from 5 to 20 grains (0.3–1.3) three times a day. It can be very effectually combined with acetphenetidin in the treatment of *neuralgia*. In *subacute rheumatic* affections it is certainly very useful.

SALVARSAN.[1]

(See Arsphenamine.)

SANDALWOOD OIL.

Sandalwood oil (*Oleum Santali*, U. S. and B. P.) is derived from the wood of *Santalum album*, a tree of India, and has a hot, burning taste. In overdose the oil is capable of producing great irritation of the genito-urinary passages.

Therapeutics.—The oil of sandalwood is much used by genito-urinary surgeons in *chronic gonorrhea* and *gleet*, and in *chronic cystitis*.

In the subacute stage of *bronchitis*, when the expectoration is thick and ropy, the oil is efficacious. In the *excessive cough* following influenza it is of great value. In all cases it should be given in capsule in the dose of 5 to 20 minims (0.3–1.3), 5 minims (0.3) being usually sufficient, although druggists generally keep it in 10-minim (0.6) capsules.

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[1] By using the American name arsphenamine physicians will avoid employing a German-made product and so directly rewarding the holders of German patented articles.

SANTONIN.

Santoninum, U. S. and B. P., is a neutral principle derived from Levant worm-seed or Santonica, which is the unexpanded flower-heads of *Artemisia pauciflora* (*Maritima,* B. P.), a plant of Asia Minor and Turkestan. Santonin is soluble in alcohol and chloroform, but slightly so in water. Santoninic acid is formed by warming santonin with alkalies, and Hesse has found that santonin is an anhydride of santoninic acid. Santoninic acid is more soluble than santonin.

Poisoning.—Santonin causes, when taken in overdose, muscular tremors, convulsive movements, unconsciousness, and sometimes epileptiform convulsions.

One of the most common symptoms of the poisoning is chromatopsia or xanthopsia, during the existence of which all objects look yellow. This is due to the staining of the humors of the eye by the drug. This may go on to total blindness or pass away in a few days. If the vision is not yellow, it may be green. The urine is also stained—first yellow, then saffron, and finally purple-red, or is bloody looking. This is not due to the presence of blood, but to the drug. Poisonous doses of the drug do *not* cause gastro-enteritis.

Therapeutics.—Santonin is used for the removal of the *round-worm,* and is very efficacious. It has no influence on the tape-worm. It should be given in the manner of all vermifuges (see Worms)—namely, at a time when the alimentary canal is empty. Santonin is said to have a distinct influence over vision, increasing, in medicinal amount, its acuity whenever the optic nerve is at fault. In *urinary incontinence* santonin will often produce a cure after all other remedies fail.

Santonin may be given in the dose of 1 to 2 grains (0.06–0.12) to an adult in capsule or wafer. The crystals should be used, not the powdered santonin. Immediately after the drug is used, a 2- or 3-grain (0.12–0.2) dose of calomel is to be taken, and followed by a saline purge six hours later, as the flow of bile caused by the mercurial is particularly useful in making the worm let go its hold.

Santoninate of sodium (*Sodii Santoninas*) is a useless, harmful preparation, never to be employed except for the benefit of the eye when vision fails through disease of the optic nerve. Introduced into medicine because of its solubility, it is absorbed into the system, which is just what is least desired in an anthelmintic, which should seek the worm in the bowel, not by entering the blood. In eye affections the dose may be from 2 to 8 grains (0.12–0.50) a day, according to the age of the adult.

Untoward Effects.—In addition to the curious effects already named santonin may cause urinary incontinence even in medicinal dose.

Administration.—Santonin is best given in the form of a troche or lozenge (*Trochisci Santonini,* B. P.) 1 grain (0.06) each, but it is to be distinctly borne in mind that the *Trochisci Sodii Santoninatis* of the U. S. P. of 1880 are not to be sold to the patient. A useful recipe is as follows:

℞—Santonini	gr. v (0.3)
Pulveris sacchari albæ	ʒiij (12.0)
Pulveris acaciæ	gr. viij (0.5)
Misce bene, et adde	
Mucilaginis acaciæ	gtt. xvj (1.0)
Aquæ	q. s.
Ft. in troches No. x.	
S.—One or two lozenges, as directed.	

SARSAPARILLA.

Sarsaparilla, U. S., is devoid of any marked physiological action, yet seems to possess some power over the general condition of the system. Thus while sarsaparilla seems utterly without effect in the hands of most physicians when given alone, it often seems to do good and to increase the effects of other drugs when combined with them, so that some cases of syphilis which are of an obstinate character are said to yield to iodide of potassium and sarsaparilla when the iodide alone fails. Sarsaparilla is largely used in domestic medicine as a "blood-purifier," and is a prominent constituent of many patent medicines. It is useless for such purposes and is a much overrated remedy.

Administration.—Sarsaparilla is most commonly given in the form of the compound syrup (*Syrupus Sarsaparillæ Compositus*, U. S.), composed of sarsaparilla, sassafras, liquorice, gaultheria, and anise, dose 1 to 4 fluidrams (4.0–16.0). (See Iodide of Potassium.) The other official preparations of the U. S. P. are the compound fluidextract (*Fluidextractum Sarsaparillæ Compositum*), similar to the syrup in composition, dose ½ to 1 fluidram (2.0–4.0). The fluidextract is no longer official, dose ½ to 1 fluidram (2.0–4.0). The B. P. preparation is a liquid extract (*Extractum Sarsæ Liquidum*), dose ½ to 4 fluidrams (2.0–16.0); and *Liquor Sarsæ Compositus Concentratus*, dose 2 to 8 drams (8.0–30.0).

SCAMMONY.

Ipomœa, Scammoniæ Radix, B. P., is a mixture of gum-resins from the root of *Ipomœa orizabensis*. Its active principle is sometimes called jalapin.

Therapeutics.—Scammony is an irritant, drastic, hydragogue purge, which causes a good deal of griping and exerts a cholagogue effect. If an inflammatory condition of the bowels is present, its use is contraindicated.

The ingestion of poisonous doses is to be followed by treatment suitable for gastro-enteritis. Scammony is given in the dose of 2 to 5 grains (0.12–0.3), always in combination with some other similar drug—as, for example, colocynth. Scammony forms part of the compound extract of colocynth (*Extractum Colocynthidis Compositum,* U. S. and B. P.), the dose of which is 1 to 3 grains (0.06–0.19) as a laxative, 5 to 20 grains (0.3–1.3) as a purge; 2 to 8 grains (0.13–0.52) B. P. The resin (*Resina Ipomœæ, Scammoniæ Resinæ,* B. P.) is given in the dose of 3 to 8 grains (0.19–0.52). The B. P. preparations of scammony are *Pilula Scammonii Composita,* dose, 5 grains (0.3), and *Pulvis Scammonii Compositus,* dose, 10 to 20 grains (0.65–1.3). The last two preparations are composed of scammony, ginger, and jalap.

SCARLET RED.

Medicinal scarlet red occurs as a dark reddish-brown powder which is insoluble in water and but slightly so in cold alcohol, acetone, ether, and benzene. It is, however, soluble in chloroform and very soluble in fats and oils, and slightly soluble in petroleum and paraffin. For these reasons lard should be used as the ointment base, not petrolatum. Its chemical name is amido-azo-toluene-azo-beta-naphthol.

Therapeutics.—Scarlet red is used to stimulate the growth of epithelium over clean granulating surfaces, which are in turn covered with a sterile dressing which should not remain in place more than forty-eight hours. If the part affected is very acutely inflamed it must be used with caution, if at all. After it has been applied in ointment for twenty-four to forty-eight hours it should be followed by a soothing salve, as of pure lanolin. After the part is cleansed with warm water and soap scarlet red can be applied to *bed-sores, leg ulcers, slowly healing burns* and on clean *venereal* and *syphilitic ulcers* in ointment form of 2 to 8 per cent strength. In many instances in place of the ointment an emulsion formed by dissolving scarlet red in a mild aqueous jelly is preferred. Its strength is 4 per cent. If the ulcer is very large the ointment should be applied only around the edges. It is not antiseptic in its action. The 5 per cent ointment commonly found in the market, diluted one-half with liquid albolene, is a useful application in *ozena* after the crusts have been removed with peroxide of hydrogen. It has been used to aid in the healing of *perforation of the tympanic membrane.* In the latter cases the treatment must be stopped every few days to avoid excessive stimulation and irritation.

SCOPARIUS AND SPARTEINE.

Scoparius (*Scopari Cacumina,* B. P.), or broom, is the tops of *Cystisus scoparius.* It contains scoparin and sparteine, the first being a crystalline principle and the second a liquid alkaloid. The second (sparteine) is the alkaloid used in medicine in the form of a sulphate (no longer official), which is a crystalline salt readily soluble in water.

Physiological Action.—CIRCULATION.—There exists absolute contraindication between the views of clinicians and pharmacologists as to the circulatory effect of this drug. Clinicians use it as a circulatory stimulant, but pharmacologists class it as a circulatory depressant. The latter are probably correct, and the improvement in certain patients after the use of sparteine is probably due to its power as a cardiac sedative, whereby an overacting heart is quieted. It is certain that the use of sparteine in grave cardiac failure is not only useless but contraindicated.

Respiration.—Upon this function sparteine, in small amounts, has no effect, but poisonous doses kill by paralysis of the respiratory center.

Kidneys.—There is little evidence to prove that sparteine acts directly on the kidneys. MacNider believes from his investigations that when diuresis is produced by its use the increased flow is due to a rise in blood-pressure, but Cushny says that scoparin is the active agent on the renal cells.

Poisoning.—The symptoms of poisoning consist in trembling and incoördination of movement, and clonic and tonic convulsions, followed by a second stage of depression of the nervous system and general enfeeblement.

Therapeutics.—Sparteine sulphate has been recommended in all states of the heart in which digitalis is of service, and it is sometimes useful in those fairly frequent cases where digitalis fails. In *cardiac arrhythmia* or *palpitation* it is thought to be of great service by those who have used it most. Clark found it of value in *Graves's disease* and in nearly every circulatory abnormality, but in the judgment of the author sparteine is not a very useful drug—one only to be turned to as a last resource after more generally used remedies fail; or, in other words, it is not a remedy to be employed as a "stand-by" in the manner in which digitalis is used.

In the few cases in which it has been used by the writer it failed to be of service, perhaps because the cases were desperate and the drug was tried after all the other remedies had failed. The dose is as variable as its action. Some state it to be $\frac{1}{20}$ grain (0.003), while still others recommend 2 to 4 grains (0.12–0.25). The latter dose is more nearly the correct one. To get the best effects it should be given every two hours in the dose of 1 grain. The drug should be given in watery solution or in pill.

One or 2 grains (0.06 0.12) given hypodermically are said to be useful for *suppression of urine* after operations.

Potts claims to have found sparteine of value in the treatment of tremor, as in *paralysis agitans*, in the dose of $\frac{1}{4}$ to $\frac{1}{2}$ grain (0.015–0.03) three times a day.

Scoparius itself is used in decoction, made by adding $\frac{1}{2}$ ounce (16.0) of the broom-tops to 1 pint (480) of water, and boiling them down to $\frac{1}{2}$ pint (240). Of this 1 ounce should be taken every three hours. This decoction is one of the most efficient diuretics in *cardiac dropsy*. The official preparations of the B. P. are an infusion (*Infusum Scoparii*), and the juice (*Succus Scoparii*), dose 1 to 2 drams (4.0–8.0).

SCOPOLAMINE.

Scopolamine, or hyoscine, is an alkaloid derived from the dried rhizome of *Scopola Carniolica,* and nearly related to plants which possesses medicinal powers closely resembling those of belladonna and its sister drugs. Its physiological action is particularly closely allied to that of the alkaloids of hyoscyamus. As stated in the article on Hyoscine, it has been introduced in its stead. The terms hyoscine and scopolamine are used interchangeably. (See Hyoscine.)

Scopolamine itself is rarely employed, the hydrobromide (*Scopolaminæ Hydrobromidum,* U. S.) being preferable. It also occurs as the hydriodide and hydrochloride. This alkaloid apparently gives better results than any other in the control of *Parkinsonianism* and slobbering in cases who have passed through the acute stages of *encephalitis lethargica.*

Scopolamine administered hypodermically with morphine has been largely used by some surgeons for the production of *general anesthesia,* the condition being produced by the administration of these drugs at intervals of from one to three hours for two to four doses preceding the time of operation. In most cases one or two doses only are employed to cause primary stupor, which is then maintained by the administration of ether or chloroform. The dose of scopolamine used for anesthesia has usually been $\frac{1}{100}$ grain (0.0006), combined with $\frac{1}{12}$ grain (0.005) of morphine sulphate, at each injection. The so-called "scopolamine-morphine method," when used to supplant ether and chloroform, has not proved popular, and experience seems to indicate that it is by no means devoid of danger, but when a single dose is used before a general anesthetic is given it allays fear, lessens the amount of anesthetic needed, decreases postanesthetic vomiting and tends to make the patient sleep for several hours after the operation.

Scopolamine and morphine have also been used together to relieve the *pains of labor.* Before the twin drugs are given care must be exercised to be sure labor has actually begun. The patient is scrubbed and prepared and then the scopolamine, $\frac{1}{150}$ grain (0.00043), and $\frac{1}{6}$ grain (0.01) of morphine sulphate are injected hypodermically when the pains are occurring about every four or five minutes and lasting for thirty seconds. Such a dose usually acts in about one-half hour, causing sleep between the pains. If this is not sufficient to markedly relieve pain the dose of scopolamine, *without the morphine,* is repeated after forty-five minutes.

In order to determine how effective the dose is the patient is told to touch the tip of her nose with her forefinger, her eyes being covered. If she fails to make this coördinated movement another dose is not necessary. This state of incoördination usually ensues after the third injection. The size of the third dose is usually less than the first or second.

The patient should be protected from noise and bustle after the first dose is given, the eyes bandaged and the ears stuffed with oiled cotton. This treatment is said to cause a painless labor devoid of accident to the mother, and, although the groaning of the woman may indicate pain, she usually states afterward that she has not suffered. It is probably not as safe for the child, and all are agreed that the patient must be carefully watched, that it should be used with care, and only in a lying-in institution, where the patient can be continually watched. If the scopolamine method is used it is probably the better practice to employ it solely in the first stage of labor, and further pain dealt with by the use of a general anesthetic which is not needed in as large doses as if used alone and which must be given with caution.

The chief field for this plan is in primipara whose first stage is prolonged and in multipara who have had repair operations after previous labors. It is contraindicated in patients with eclampsia, placenta previa and cardiac disease without good compensation. It is also contraindicated if the physician has not the time to "stand by" the patient.

SEIDLITZ POWDER.

Under the official name of *Pulvis Effervescens Compositus* the U. S. P. recognizes a purgative powder (*Pulvis Sodæ Tartaratæ Effervescens,* B. P.) made by taking the bitartrate of sodium and potassium, or Rochelle salt 120 grains, and bicarbonate of sodium 40 grains, which are wrapped in blue paper, and 35 grains of tartaric acid placed in a white paper. The contents of each paper are dissolved in water—½ tumblerful—and the two solutions added to one another and swallowed during effervescence. As much as two powders may be used, but this is generally too large an amount unless full purgation is needed. In *sick stomach* associated with *constipation,* when a whole powder cannot be retained, the two powders should be divided into fourths, and a fourth added to a fourth dissolved in ½ wineglassful of water and taken every fifteen minutes until the entire powder is ingested. This will often settle the stomach and produce purgation.

SENEGA.

Senega, U. S. (*Senegæ Radix,* B. P.) is the root of *Polygala senega,* a small plant of the United States, containing a principle known as polygalic acid and senegin.

Therapeutics.—Senega is used in medicine as a stimulating expectorant in the subacute and chronic forms of *bronchitis.* It has also been employed as a diuretic in *cardiac dropsy* or that due to renal disease. In cardiac disease it should not be used, and indeed it is rarely employed at present except in combination with other drugs in expectorant mixtures.

Administration.—Senega is used in the form of the fluidextract (*Fluidextractum Senegæ*) U. S.), dose 10 to 20 minims (0.6–1.3) and the syrup (*Syrupus Senegæ*, U. S.), dose 1 to 2 drams (4.0–8.0). It is also used in Coxe's Hive Syrup. The official preparations of the B. P. are—a tincture (*Tinctura Senegæ*), dose 1 to 2 drams (4.0–8.0), and an infusion (*Infusum Senegæ*), dose 1 to 2 ounces (30.0–60.0).

SENNA.

Senna, U. S., is the most drastic of the laxative purges used for the relief of *constipation*. It is the leaflets of *Cassia acutifolia* and *Cassia angustifolia*, and contains a very acrid irritant purgative principle known as cathartic acid. Senna is official in the B. P. as *Senna Indica* and *Alexandrina*.

Physiological Action.—Senna acts as a purge, producing copious stools, often with much griping if it is used alone. According to Rutherford and Vignal, it materially increases the flow of bile, but it is seldom, if ever, used in medicine as a cholagogue, although, according to Prevost and Binet, cathartic acid has an influence over biliary secretion. Hess has found that the drug acts directly as a stimulant upon the mucous membrane, and so produces a local peristalsis as it is moved along. It is also known that the drug is eliminated in the milk, and for this reason care should be taken in giving the drug to nursing mothers, as it will purge the nursling.

Administration.—Senna is generally combined with other drugs for the relief of constipation, but may be used alone. If this is done, the fluidextract (*Fluidextractum Sennæ*, U. S.) may be employed in the dose of 1 to 2 drams (4.0–8.0) to a child or 4 drams (16.0) to an adult. It is, however, always better to give children the more agreeable confection (*Confectio Sennæ*, U. S. and B. P.) in the dose of ½ dram (2.0) to a child, or 1 to 2 drams (4.0–8.0) to an adult. As the confection is apt to cause gastric disorder if used continuously because of the sugar contained in it, its use is limited to a small class of cases.

In the treatment of the *constipation of pregnancy* senna is thought to be very useful. In these cases and in other where cascara sagrada alone will not move the bowels, senna may be prescribed as follows:

℞—Fluidextracti sennæ	f℥ij (60.0)
Fluidextracti cascaræ sagradæ	f℥j (30.0).—M.

S.—Teaspoonful (4.0) at night, or night and morning.

Should this produce griping 1 to 5 minims (0.05–0.25) of fluidextract of belladonna may be added to each dose. Under the name of Black Draught a mixture of senna, manna, fennel, and sulphate of magnesium has been largely used (*Infusum Sennæ Compositum*) in the dose of 4 ounces (120.0). It is an active hydragogue purge. The syrup (*Syrupus Sennæ*, U. S. and B. P.) is given in the dose of 1 to 4 drams (4.0–16.0).

One of the best ways to use senna is in the compound liquorice powder (*Pulvis Glycyrrhizæ Compositus,* U. S. and B. P.), which is a good laxative in the dose of 20 to 30 grains (1.3–2.0), 1 to 2 drams (4.0–8.0), B. P. Compound liquorice powder is composed of senna, liquorice, oil of fennel, washed sulphur, and sugar.

Infusum Sennæ, B. P., is given in the dose of 1 to 2 ounces (30.0–60.0); *Mistura Sennæ Composita,* B. P., in the dose of 1 to 2 ounces (30.0–60.0); and *Tinctura Sennæ Composita,* B. P., in the dose of 1 to 4 drams (4.0–16.0). *Liquor Sennæ Concentratus,* B. P., is given in the dose of 1 dram (4.0).

Senna, because of its chrysophan, may stain the urine carmine if that fluid is alkaline, or yellow if it is acid. No alarm should be felt if either color appears in this secretion. Often it is necessary to warn the parents of a child of the possibility of such an occurrence, in order to prevent alarm on the part of the mother, who otherwise may think that hematuria was present.

SERPENTARIA.

Serpentaria, U. S. (*Serpentariæ Rhizoma,* B. P.), or Virginia snakeroot, owing to its rather pleasant warm taste and the fact that it stimulates secretion, is used largely as a vehicle for other more potent remedies. It has tonic properties, and in consequence has been largely used in the treatment of *atonic dyspepsia* and *indigestion.* It is said to be a sexual stimulant, but this is doubtful, to say the least. In overdose it is an irritant, and will cause vomiting and purging if large amounts are taken.

Administration.—Serpentaria is given in the form of the fluidextract in the dose of 10 to 40 minims (0.6–2.6). It also enters into Huxham's Tincture of Cinchona (*Tinctura Cinchonæ Composita,* U. S. and B. P.). *Infusum Serpentariæ,* B. P., is given in the dose of ½ to 1 ounce (15.0–30.0).

SILICATE OF POTASSIUM OR SODIUM.

Soluble glass, or silicate of potassium or sodium, occurs as a clear, syrupy fluid. It is used as a splint in the dressing of *fractures* and *sprains,* as it rapidly becomes hard and immovable when painted over the bandages. Silicate of potassium or sodium may be universally substituted for plaster-of-Paris. The solution of silicate of sodium is no longer official.

SILVER ARSPHENAMINE.

Silver arsphenamine, as its name implies, is a compound of silver with arsphenamine. In appearance it is grayish-black powder put up in an ampoule. When made into a solution it is neutral in reaction and appears dark brown in color, but if it is oxidized the powder does not readily dissolve and the fluid is opalescent. When oxidized it is toxic and must not be used. Its arsenic content is less than that of arsphenamine; 22.4 per cent arsenic and 14.1 per cent silver, whereas in the older drug the arsenic content is 30 per cent and in neoarsphenamine 20 per cent.

The exact manner in which this combination acts is uncertain, some supposing that it attacks the parasite directly while others claim that it seems to anchor the arsenic compound more effectively to the parasite. For these reasons silver arsphenamine has been advanced as superior to the older products and it has been claimed that the effective dose is less by nearly one-half. The dose usually employed is 0.1 to 0.3 gram repeated every day to every four days and the treatment is usually persisted in until from eight to sixteen injections are given. It is put on the market in ampoules holding 0.1 grams, 0.15 gram, 0.2 gram, 0.25 gram and 0.3 gram. Some give much larger and some smaller doses than this. Not more than 2 grams should be used in a month not only because of the arsenic effect, but also because argyria may be induced. It would seem that silver arsphenamine has no greater therapeutic power than arsphenamine and that if mercury is to be actively employed the silver preparation had better be supplanted by the older preparation since its use requires the system to deal with the elimination of three metals instead of two. The quantity of distilled water employed in making the solution varies with the wish of the physician, the ordinary amount being 10 cc. for each 0.1 gram used. Sometimes normal salt solution is employed. Silver arsphenamine should be injected very slowly and great care taken that it does not enter the perivenous tissues.

SILVOL.

Silvol appears in the form of black lustrous granules, slightly hygroscopic and hence very readily soluble in water. Solutions can be very quickly made, even having a concentration as high as 50 per cent by weight. Ordinary solutions containing 2 per cent or more of silvol are a brownish-black color, but when quite dilute this solution has a characteristic brownish-yellow tint. The substance is readily soluble in water and insoluble in acetone, alcohol, ether, chloroform, oils and fats.

Pharmacological tests upon animals would seem to indicate that silvol can be defined as practically "non-toxic."

Silvol is now available in the form of 1 ounce vials of the granular powder; also in capsules, each of which contains 6 grains. These latter are specially prepared for the making of solutions, it being only necessary to empty the contents of 1, 2 or more capsules in a measured quantity of water to produce a solution of such concentration as the physician may require. It also appears as silvol ointment containing 5 per cent. of the medicament.

In 20 per cent solution it is an excellent application in the nose in the early stages of *acute coryza*, and also in *acute pharyngitis*.

Injections of 10 to 20 per cent solution, three or four times per day may be used in *gonorrhea*. A 25 per cent solution is used in *ophthalmia neonatorum* and in *purulent ophthalmia*. (See Neosilvol.)

Fresh stains are removable by soap and water. Old stains by so-called "germicidal soap, that is mercuric iodide soap."

SOAP.

Sapo, U. S. (*Sapo Durus*, B. P.), is prepared from sodium hydroxide and olive oil, although other alkalies and oils may be employed in the manufacture of the soaps which are used medicinally. Castile soap, if good, is the best representative of a pure soap.

Soap may be cut into the form of a suppository and used to provoke movements of the bowel in young children who are suffering from *constipation*, by placing it just inside the anus, having previously dipped it into water an instant to make it slippery. It may also be used as an enema, dissolved in warm water, or a mixture known in Philadelphia as the "House Mixture" may be employed in the case of an adult. This consists of a mixture of water, soft soap, and molasses in varying proportions, and if *flatulence* is present turpentine and olive oil are added to it. The preparation is as efficient as it is cheap and dirty. Soap is also used as an antidote to many poisons and as an aid to emetics.

Soft soap (*Sapo Mollis*, U. S. and B. P.), often called green soap, is usually brown. It is a soft soap made by the use of potash and linseed oil, and is largely used by dermatologists in the treatment of *eczema* and similar skin diseases where a detergent, stimulating application is needed. It is sometimes called "German soft soap," to distinguish it from the ordinary soft soap of the United States, which is an impure substance often made of rancid fats, containing a large excess of alkali, and never used except for scouring purposes. Green soap is employed not only as green soap, but also in the liniment (*Linimentum Saponis Mollis*, U. S.), which is to be thoroughly rubbed into the part when used medicinally, well washed off, and afterward simple cerate or some other soothing salve applied.

Soap liniment (*Linimentum Saponis*, U. S. and B. P.), or opodeldoc, as it is called in domestic medicine, is largely used for rubbing *stiff muscles* and *sprains*. It is generally employed to carry more active external remedies, such as opium or aconite.

℞—Tincturæ aconiti,
Tincturæ belladonnæ,
Tincturæ opii . . . . āā fʒij (8.0)
Linimenti saponis . . . . q. s. ad f℥vj (180.0).—M.

Soap plaster (*Emplastrum Saponis*, U. S. and B. P.) is used as a thick, heavy protective for *bed-sores* or where the formation of bed-sores is feared. It is also used as a support about *sprained joints*.

SODIO-SALICYLATE OF THEOBROMINE.

Theobrominæ Sodiosalicylas, U. S., known as diuretin (*Theobrominæ et Sodii Salicylas,* B. P.), derives its name from the extraordinary power which it is said to possess of producing a great increase in the urinary flow from the kidneys. This power depends entirely upon the theobromine, which is a crystallizable, volatile, bitter alkaloid, closely allied to caffeine and xanthine, and derived from the seeds of *Theobroma cacao,* or the source of ordinary chocolate. Owing to the insolubility of theobromine, it has been found necessary to combine it with sodium salicylate, as under these conditions it is readily absorbed.

The diuretic properties of this alkaloid were first discovered during a series of experiments made by Schröder, in Strasburg, in 1889, who found that the diuresis produced in man and the lower animals was marked. Many clinical trials in Europe and America have confirmed his observations, but there are a number of cases in which it signally fails, particularly in chronic Bright's disease.

Theobromine does not have so stimulating an effect on the heart as does its relative caffeine, so that the circulatory effect, while showing a stimulant rather than a depressing tendency, is very slight. It slightly increases muscular power, but its peculiar affinity for the renal structure surpasses all its other activities.

As the action of the drug depends upon its ability to stimulate the secreting epithelium of the kidney, the physician should remember that in cases of advanced renal disease, where the secreting structures are almost entirely destroyed, no result can be expected from its administration; but it is probable that the drug is useful in almost all conditions of *dropsy,* whether due to renal inactivity or cardiac disease, and is harmless to the patient even if the diuretic effect does not ensue. The only contraindication, to the use of theobromine or diuretin is the presence of acute nephritis, when, of course, sedatives rather than stimulants are needed. So far as the writer is aware, no study as to the proportion of solids and liquids in the urine of patients under the influence of this drug have been made, but the fact that it stimulates the epithelium or secreting structures of the kidney would indicate that the solids are increased.

As diuretin contains only from 30 to 50 per cent of theobromine, it has to be given in very large amounts, as much as 1 to 2 drams (4.0–8.0) in twenty-four hours, preferably in divided doses of from 10 to 20 grains (0.60–1.3) in capsule or in warm water. The former method is the better, as the taste of the drug is disagreeable and soapy. Diuretin must not be exposed to the air, as it undergoes decomposition.

In many cases in which the writer has tried sodio-salicylate of theobromine he has failed to see any effect produced, and, while he has little confidence in the drug, he mentions it because others claim to have obtained good results from its use.

In the dose of 8 or 10 grains (0.5-65) three times a day it is used in cases of *angina pectoris* with the idea that it may relax spasm of the coronary arteries.

SODIUM.

Sodium is a metallic element, the salts of which are usually white and colorless. It is not used in medicine, but many of its salts are employed. While potassium acts as a depressant to the body, sodium seems to exert comparatively little effect upon the animal economy. The salts vary in their power with the acid forming them. (See Benzoate of Sodium, Salicylate of Sodium, etc.)

Acetate of sodium (*Sodii Acetas,* U. S.) is rarely if ever used in medicine as a substitute for acetate of potassium. The dose is 20 to 40 grains (1.3–2.6) three times a day.

Sodium Bicarbonate.

Bicarbonate of sodium (*Sodii Bicarbonas,* U. S. and B. P.) is largely used as an antacid in *gastric fermentation* and in *sick headaches* arising from this condition. Combined with calomel in powder, it certainly adds to its efficiency in increasing biliary flow, as all alkalies of this class liquefy and thin the bile. The drug has been widely employed in the treatment of *rheumatism,* and is found to be of great service in allaying *pain and soreness in the joints* when used in a lotion made by dissolving it in water and applying it to the part on lint or rags.

In *acidity of the stomach* the following effervescing powder is useful: Bicarbonate of sodium (*Sodii Bicarbonas*), 30 grains (2.0) in one paper, and in the other 5 grains (0.3) of tartaric acid (*Acidum Tartaricum*). These are each dissolved in ½ tumbler of water, added to one another, and swallowed during effervescence.

The common practice of freely administering sodium bicarbonate before or after operation to avoid or correct so-called acidosis is not rational. Some use it as if they thought acidosis means an increased acidity, in the ordinary sense, in the blood, which must be neutralized by the sodium. The blood is never acid in this sense. To give it beforehand, to prevent acidosis, results in the kidneys getting rid of it as fast as they can as an excess. If postoperative acidosis is feared the proper procedure is to store the liver with dextrose. If actual ketosis exists it is to be overcome by the administration of dextrose to oxidize the ketone bodies, or sodium bicarbonate with dextrose. (See Dextrose.) When sodium bicarbonate is given intravenously it must be dissolved in sterile water in the strength of 1.5 per 100 cc. Such a solution cannot be boiled as the bicarbonate will be changed into the carbonate of sodium. Sodium bicarbonate may be employed in moderate amounts, not to neutralize acidity, but to replace the sodium which has combined with the ketone bodies to aid in their elimination. Fortunately, whenever the sodium is given in excess, alkalosis is prevented, as just stated, by quick action of the kidneys. Its free use when the renal threshold is raised above normal by disease is capable of doing harm.

(For the use of sodium bicarbonate to prevent or control ketonosis see articles on Diabetes and Cholera, Part IV.)

Sodium Biphosphas.

Sodii Phosphas Acidus, B. P., or *Sodium Acid Phosphate* ($NaH_2PO_4\text{-}H_2O$), or monosodium phosphate (*Sodium Biphosphas*, U. S.), differs from ordinary sodium phosphate, which is disodium or neutral sodium phosphate (Na_2HPO_4,H_2O). When taken into the stomach it is not changed, but in the intestine it is converted into disodium phosphate and acts in a similar manner as a mild purge. The neutralization of the acid takes alkali from the blood, and as the system guards the normal alkalinity of the blood with the greatest care there is a prompt excretion of acid in the urine to maintain the normal balance. This makes an acid urine, which is desirable when it is alkaline and loaded with phosphates. It is also desirable when the colon bacillus infects the urinary tract and it is desired to get the effect of hexamethylenamine which gives off its formaldehyde chiefly in an acid urine. It is wise, therefore, to precede each dose of hexamethylenamine by some hours by a dose of 15 to 20 grains (1.0–1.3) of acid sodium phosphate. It may be given dissolved in sweetened water so as to taste like lemonade.

Sodium Cacodylate.

Sodii Cacodylas, U. S., is a white, amorphous powder which readily dissolves in water. It uses in medicine are practically identical with those of arsenic. (See Arsenic and Arsphenamine.) It is less poisonous only because the compound is so stable that arsenic is slowly set free. The drug is best administered hypodermically. The dose is 1 to 2 grains (0.06–0.12) subcutaneously, and 2 to 4 grains (0.12–0.25) by the mouth. In these doses given, as a rule, every other day it is a very efficient remedy in *primary* and *secondary anemia*. Its use by the stomach causes not only a strong, garlicky odor on the breath, but also gastric irritation, because it is decomposed in this viscus.

Murphy advised the intramuscular injection every third or fourth day of 1 to 4 grains (0.05–0.2) in *syphilis*, and stated that it destroys the spirochete of this disease, but this is doubtful. The large and small doses are now ready for use in solution in ampoules, and these should always be used.

Sodium Chloride.

Chloride of sodium (*Sodii Chloridum*, U. S. and B. P.), or common salt, is a useful drug and food, aiding in maintaining the alkalinity of the blood and tissues and in the formation of gastric juice, being changed by the lactic acid of the stomach into lactate of sodium, thereby setting free hydrochloric acid, which acts not only by aiding digestion, but in the production of pepsin from pepsinogen of the gastric tubules. The dose is 10 to 20 grains (0.6–1.3).

Normal salt solution is official under the name *Liquor Sodii Chloridi Physiologicus*, U. S. (For its use in therapeutics see article on Intravenous Injection, Part III.)

Sodium Citrate.

Sodium citrate (*Sodii Citras*, U. S.) may be used as a substitute for citrate of potassium but is less active. It has been highly recommended to aid in the digestion of milk by *bottle-fed babies* in that it prevents the formation of tough curds. When it is used it is not necessary to largely dilute cows' milk with water for these patients. The dose should be about 1 to 2 grains (0.05–0.1) to 1 ounce (30.0) of milk. The same drug may be used with advantage in cases of difficult milk digestion in adults suffering from *gastric ulcer, gastritis*, and *typhoid fever*. (See Buttermilk in Part III, Foods for the Sick.) It is also used to prevent coagulation of blood in the practice of indirect *blood transfusion*. A 2 per cent solution is prepared and used in such a proportion that the amount of sodium citrate in the injected blood does not exceed 0.2 per cent. (See Transfusion, Part III.)

Although sodium citrate in weak solution is used to prevent coagulation of blood it has been found that strong solutions aid coagulation. Thus 30 cc. of a 30 per cent solution are injected very slowly, intravenously to prevent hemorrhage at operation and for internal hemorrhages.

In the proportion of 10 grains (0.65) of sodium citrate and 20 grains (1.3) of sodium chloride to 1 ounce of water (30.0) it is used under the name of Wright's Solution as a wet dressing over small wounds and abrasions, over *felons* and *deep brush burns*.

Sodium Ethylate.

Sodium ethylate is a whitish powder decomposed in the presence of water into alcohol and caustic soda, but soluble in absolute alcohol without decomposition.

Sodium ethylate is employed in medicine as a depilatory—that is, for the purpose of removing *hairy growths*. To accomplish this purpose it is necessary that the growth be clipped close to the skin, and that the drug be dissolved in absolute alcohol and applied over the roots of the hair with a glass rod. Soon after this application a crust forms, which should not be detached for two or three weeks, but which, in its removal at the end of this time, generally shows that all the roots of the hair have been destroyed. If not, the operation may be repeated as soon as the skin is in a condition to bear it. To prevent pain, a 5 per cent solution of cocaine may be used hypodermically at the spot to be cauterized. It is worthy of remembrance that moles and small birthmarks, or nævi, may be removed by a similar application. Small scars may result.

A solution, *Liquor Sodii Ethylatis*, is official in the B. P.

Sodium Hydroxide.

Sodium hydroxide (*Sodii Hydroxidum*, U. S., *Soda Caustica*, B. P.) is milder than caustic potash, and its action is more readily controlled. It should be used in the same way and for the same purpose as is caustic potash, and the surrounding skin should be protected by adhesive plaster and oil or ointment.

The soda must be kept in well-stoppered bottles made of hard, strong glass. The only official preparation in the U. S. P. is the 5 per cent solution of sodium hydroxide, *Liquor Sodii Hydroxidi.*

Sodium Iodide.

Sodii Iodidum, U. S. and B. P., is actually superior to potassium iodide in that it is less irritating to the stomach and less depressant to the heart. It is also far better in nephritis, since in this condition the potash salts are often retained and act as depressants. In other respects the effects are identical. (See Iodide of Potassium.)

Many strongly commend the intravenous use of sodium iodide in the strength of 8 per cent in sterile distilled water and gives doses varying from 10 to 30 grains in this manner by syringe or arsphenamine apparatus. The solution can be sterilized by boiling.

Sodium Perborate.

This is a compound formed by treating sodium peroxide with boric acid. When it is added to water it sets free hydrogen dioxide which exercises an antiseptic effect. In the proportion of 1 dram to 6 or 8 ounces (4.0–180–240) it is a useful mouth-wash in infections of the mouth, notably in *Vincent's angina.* It may be placed on a tooth brush.

Sodium Phosphate.

Sodii Phosphas, U. S. and B. P., is a preparation which has been used with the idea that it can supplant phosphorus. This is, of course, an error, as it has an entirely different effect. It is particularly useful for bottle-fed children, who continually alternate between *diarrhea* and *constipation,* and is also useful in cases of *rickets* to regulate the bowels. It should be added to each bottle of milk in the dose of 2 to 4 grains (0.12–0.25). Phosphate of sodium in small doses is slightly laxative, and large doses are purgative. Bartholow believed phosphate of sodium to be the best remedy in *hepatic cirrhosis* and *jaundice.*

To adults it should be given in the dose of 20 grains to 2 drams (1.3–8.0) once, twice, or thrice a day according to the laxative effect desired. It is best given dissolved in a teacupful of hot water.

Many cases of general wretchedness or headache due to autointoxication are relieved by the phosphate of sodium.

The U. S. P. and B. P. also recognizes a preparation called *Sodii Phosphas Effervescens;* dose 2 to 4 drams (8.0–16.0). *Sodii Phosphas Exsiccatus* (U. S.) is about twice the strength of the ordinary phosphate; dose ½ to 1 dram (2.0–4.0).

(For an explanation of the purgative action of most salines see article on Magnesium Sulphate.)

Sodium Salicylate.

Sodii Salicylas, U. S. and B. P. is nearly always used as a substitute for salicylic acid when given internally as it is not so irritating to the stomach. Its dose is 10 to 60 grains (0.65–4.0) three or four times a day. (See Salicylic Acid and Strontium.)

Sodium Sulphate.

Sodii Sulphas, U. S. and B. P., or Glauber's Salt, is one of the irritant saline purges, rarely used in medicine by itself for human beings, but largely employed by veterinarians. The purgative dose for man is ½ to 1 ounce (16.0–30.0). If any intestinal inflammation is present, it is contraindicated. It produces large watery stools, with a good deal of griping. Sulphate of sodium is a prominent constituent of Carlsbad water and many other foreign waters. (For an explanation of the action of salines in producing purgation, see Magnesium Sulphate.)

Reverdin has recently claimed that small doses of 2 grains (0.12) of sulphate of sodium every hour are of great value in controlling *capillary hemorrhages.* It must be given by the mouth or intravenously. If given hypodermically he asserts it is useless.

Under the name *Sodii Sulphas Effervescens* the B. P. recognizes an effervescent preparation of sodium sulphate, given in the dose of 2 to 4 drams (8.0–16.0).

Sodium Sulphocarbolate.

(No longer official.)

Sodium Thiosulphate.

Thiosulphate of sodium (*Sodii Thiosulphas,* U. S.) or hyposulphite of sodium, occurs in large, transparent, colorless plates which effloresce when exposed to the air. It has a slight alkaline reaction, and is soluble in about equal parts of water, but insoluble in alcohol.

Therapeutics.—Thiosulphate of sodium is used in the proportion of 1 dram (4.0) to 1 ounce (30.0) of water or lard in the treatment of parasitic skin diseases, particularly those due to the trichophyton fungus, such as *pityriasis versicolor.* It is also efficacious, locally applied, in *rhus poisoning* in the following prescription:

℞—Acidi borici,		
Sodii thiosulphatis,		
Resorcini	āā	gr. xv–xxx (1.0–2.0)
Aquæ		f℥viij (250)

S.—Apply on compresses.

It may also be used for *pruritus* in the strength of ½ dram (2.0) to 1 ounce (30.0) of water. In *malarial hematuria* sodium thiosulphate is often given with advantage in the dose of from 10 to 30 grains (0.60–2.0) every four hours. How it acts in this condition is not known, but as this salt renders the urine alkaline it may serve to protect the kidney tissues, for Dodds and Baker[1] have shown that if free hemoglobin is placed in the blood-stream acute nephritis develops if the urinary secretion is acid, whereas such damage does not occur if the urine is alkaline. On the other hand, other sodium salts which make the urine alkaline do not seem to be so efficacious.

This salt in chemically pure form and dehydrated has been used with great success by intravenous injection in the treatment of the alarming reactions and for the relief of the *jaundice* and *severe dermatitis* which sometimes follows the use of arsphenamine in the treatment of syphilis. Furthermore it may be given simultaneously into a different vein, as a prophylactic in the dose of 5 cc. of a 10 per cent solution, when untoward effects of arsphenamine are feared, without impairing the efficiency of the arsenical as a parasiticide. Sodium thiosulphate in the dose of 30 grains (2.0) should be given in water in *bichloride of mercury poisoning* as an antidote since it changes the mercurial salt into a relatively less toxic monovalent form. A full teaspoonful in a glass of warm water is an antidote to *iodine poisoning.*

Its intravenous use has also proved of service in *chronic lead poisoning* and it is to be thought of in the presence of cases of acute and chronic arsenical poisoning when ordinary arsenic compounds have been inhaled or swallowed. The drug apparently aids in the elimination of arsenic and lead in the urine as does iodide of potassium. It has also given excellent results in the treatment of *mercurial stomatitis* and the sore mouth following the use of bismuth in the treatment of syphilis. The amount of the salt usually given intravenously for the conditions above described averages 10 grains (0.65) in 5 cc. of distilled water every second day until the patient is relieved. Solutions of this salt are decomposed if boiled. When arsphenamine has escaped by error into the perivascular tissues the threatened inflammation can be modified if the syringe is disconnected and sodium thiosulphate in the dose of 12 grains (0.75) in 8 cc. of water injected through the needle while it is still in place.

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[1] British Jour. Exper. Pathol., 1925, p. 247.

When used intravenously the solution should be freshly prepared. It is now placed on the market in concentrated solution 7½ grains sterile ampoules ready for injection after dilution.

Thiosulphate of sodium is largely used as a food preservative and in the amounts usually employed is harmless.

SPIGELIA.

Spigelia is sometimes called pinkroot.

Poisoning.—The symptoms of poisoning by spigelia closely resemble those of belladonna poisoning.

Therapeutics.—Spigelia is one of the most efficient remedies in the removal of *round-worms,* and is not dangerous when given with care. When employed for the removal of worms, the usual precaution should be taken in regard to the ingestion of food (see article on Worms), and the drug should be followed by a purge to sweep out the worm while it is narcotized. The purge should be one which is rapid in its action, such as the sulphate of magnesium.

Administration.—The dose of spigelia in the form of the fluidextract (no longer official), is 2 drams (8.0); that of the unofficial fluidextract of spigelia and senna (*Fluidextractum Spigeliæ et Sennæ*) is ½ to 1 dram (2.0–4.0) for a child of two years of age; ½ ounce (16.0) is the dose for an adult. The addition of fluidextract of senna makes the drug more efficient, and the mixture is generally not disliked by children.

SQUILL.

Scilla, U. S. and B. P., contains scillin, scillipicrin and scillitoxin, all of which possess poisonous properties, and none of which is used in medicine alone, except by few practitioners.

Poisoning.—In poisonous doses squill produces vomiting, purging, dulness, stupor, intermittent palsy, convulsions and death in ten to twenty hours. These symptoms are preceded by a marked fall in temperature. The urine is suppressed or bloody and acute nephritis is produced. Gastro-enteritis may be marked.

Physiological Action.—Squill possesses a physiological effect upon the heart closely allied to that of digitalis, and is thought by some to be capable of stimulating the heart muscle more powerfully than digitalis. Like digitalis, it is capable in overdose of inducing cardiac arrhythmia and even heart block. (See Digitalis.)

It increases diuresis not only by raising blood-pressure in the kidney, as does digitalis, but by stimulating the secreting epithelium as well. In overdose it is a renal irritant.

Therapeutics.—Squill is largely used as a stimulant or irritant diuretic, to affect the renal epithelium directly and promote secretion, and to tone up and excite to normal effort a kidney depressed by disease, as in *chronic Bright's disease* or renal congestion from cardiac trouble. In *cardiac dropsy,* when combined with digitalis, squill is a standard and much-used remedy, and is undoubtedly of value in aiding in the absorption of *effusions in the pericardium, pleura,* and *abdomen.* (See Digitalis.) Squill is usually given in *cardiac dropsy,* in pill form, as follows:

℞—Pulveris scillæ	gr. x (0.6)
Pulveris digitalis foliorum	gr. xx (1.3).—M.

Fiant pilulæ No. x.
S.—One t. i. d. after meals.

The employment of squill in *bronchitis,* although largely resorted to, is not to be commended, since its irritant action on the kidneys and stomach may cause trouble. The period for its administration is in the beginning of the second stage, when secretion is scanty or so excessive as to need proper stimulation of the mucous membranes to bring on a healthy action. At one time Coxe's Hive Syrup was largely used, either as an emetic in dram doses every ten minutes until it acted, or as an expectorant in the dose of 30 minims to 1 dram (2.0–4.0) three times a day for an adult. As it contains antimony, it should be given with care.

Squill may be used as a substitute for digitalis when the latter remedy fails in cases of *ruptured cardiac compensation* associated with valvular disease. If after the use of squill for some days the urine diminishes in amount, the drug must be stopped, as this condition indicates spasm of the renal vessels or acute irritation.

Administration.—The fluidextract (*Fluidextractum Scillæ,* U. S.) is much used in the dose of 1 to 5 drops (0.06–0.3); the tincture (*Tincturæ Scillæ,* U. S. and B. P.) in the dose of 5 to 30 minims (0.3–2.0); the vinegar of squill (*Acetum Scillæ,* U. S. and B. P.) in the dose of 10 minims to ½ dram (0.6–2.0). The B. P. dose is 5–15 minims (0.03–1.0). The compound syrup (*Syrupus Scillæ Compositus,* U. S.), or Coxe's Hive Syrup, is composed of the fluidextract of squill, fluidextract of senega, tartrate of antimony and potassium, purified talc, sugar, and water, and is given in the dose of 20 minims (1.3) as a sedative to an adult and 1 dram (4.0) as an emetic to a child.

The following prescription will be found useful in *bronchitis* in its subacute stages in a child of one to five years:

℞—Syrupi ipecacuanhæ	f ʒj (4.0)
Tincturæ scillæ	f ʒss (2.0)
Syrupi tolutani	f ʒv (20.0)
Aquæ	f ℥j (30.0).—M.

S.—Teaspoonful (4.0) every three or four hours.

The plain syrup (*Syrupus Scillæ,* U. S. and B. P.) is given in the dose of ½ to 1 dram (2.0–4.0), the honey (*Oxymel Scillæ,* B. P.) in the dose of ½ to 1 dram (2.0–4.0), and the compound pill (*Pilula Scillæ Composita,* B. P.) in the dose of 5 to 10 grains (0.3–0.6).

STARCH.

Amylum, U. S. and B. P., is corn starch, that is the starch grains of *Zea mays*. In very fine powder starch is used as a dusting powder in *intertrigo* or *chafing*. Its more important uses are, however, in the form of starch-water for carrying drugs into the rectum, and in the form of a poultice for cases of skin diseases where it is desired to remove crusts.

Starch-water is made by adding 2 tablespoonfuls of starch to 1 pint of water, then boiling it to a paste and diluting it by the addition of warm water to the consistence of syrup. Starch-water is not only useful as a vehicle for drugs given by the rectum, but also as a sedative injection in *proctitis* and *rectal irritation*.

The starch poultice is made by boiling the starch to a pasty consistence or by adding enough boiling water to a paste made by rubbing cold water and starch together to produce a gelatinous mass. Thirty grains (2.0) of boric acid to the ounce (30.0) render it antiseptic.

STOVAINE.

Stovaine is a synthetic substance used for the purpose of producing local anesthesia. Technically speaking it is the hydrochloride of alpha-dimethylamine-beta-benzoylpentonal. In other words, it has a chemical composition closely allied to that of the other drugs which cause local anesthesia.

Stovaine appears in small, brilliant scales and is very soluble in water, methyl alcohol, and acetic ether. An important characteristic of stovaine is that it is not decomposed by boiling its solutions.

The toxicity of stovaine when absorbed into the general system is said to be one-half that of cocaine. Instead of constricting blood-vessels in the area to which it is applied, it dilates them, and for this reason hemorrhage is more profuse in the wounded area when it is used than when cocaine is applied. When used for its anesthetic effect in the eye, stovaine should be dissolved in normal salt solution in the strength of from 1 to 4 per cent. The 1 per cent solution is used for subconjunctival injections and the 4 per cent solution for instillations. For local anesthesia by Schleich's method a solution of 0.7 per cent is used. (See Cocaine.) The drug can also be employed for *spinal anesthesia*—15 minims (1 cc.) of normal salt solution containing 1 grain (0.06) of the drug are injected. As a rule, however, it is best to use a fluid with a heavy specific gravity in order to limit the effect of the drug to the region in which it is injected, as, for example: stovaine, 1 grain; glucose, 1 grain; and sterile water, 20 minims (1.3). (For method, see Procaine.) It is hardly necessary to state that this solution must be sterilized by boiling before it is injected. Untoward effects following this use of stovaine are said to be rarely met with, but when they have developed they have consisted in profuse sweating, vomiting, headache, and, in a few instances, relaxation of the sphincters. (See Cocaine and Tropacocaine.) Spinal anesthesia is not as safe as anesthesia produced by the careful use of ether or chloroform.

STOVARSOL.

Stovarsol, sometimes called Acetarsone, or Spirocid, contains about 27.1 per cent of arsenic and is employed in the treatment of *amœbic dysentery* and for the removal of *intestinal parasites* in addition to its use in the treatment of *syphilis*.

Because of its acid reaction it cannot be used intravenously. It is the one potent arsenical for *syphilis* which can be given by the mouth in the form of tablets. It is best to give it in doses of 15 to 30 grains (1.0–2.0) per day until not less than ½ ounce (15.0) or more has been taken, and the patient watched for evidence of renal irritation. After a full course of stovarsol has been given for syphilis Oppeheim gives a course of arsphenamine and then resorts to mercury by intramuscular injection or by inunction. It has been used as a prophylactic against syphilitic infection before and after intercourse with success in the doses stated. Because it can be given by the mouth it is useful in *infantile congenital syphilis*, the dose being 1½ grains (0.09) to the kilo.

Although the above doses represent the amounts used in France, it is noteworthy that in this country they are regarded as too large. Thus Craig states that in *amœbic dysentery* doses as large as 4 grains (0.25), given in the form of the ready-made tablet, three times a day, often cause gastro-intestinal distress and an erythematous rash. He found that one-half tablet was quite efficient when given three times a day for a week followed by an intermission of seven days. It would appear that stovarsol is even more efficient than emetine and it possesses the great advantage of use by the mouth instead of by the needle under the skin or by the vein. It is also the only efficient drug in amœbic dysentery which can be used successfully in treating carriers or those not ill enough to be kept in bed.

Stovarsol has been shown to be a useful remedy, about equal to quinine in tertian *malarial fever* (Plasmodium vivax), but it seems to have little power when the infection is of the quartan type (Plasmodium malariæ) or the æstivo-autumnal type (Plasmodium falciparum). It is to be borne in mind by the physician, however, in cases of tertian infection which cannot tolerate adequate doses of quinine or those in which the parasite seems immune to that drug.

Stovarsol is marketed in tablets of 0.25 gram which are marked by a central crease which enables the patient to easily break them in half if a smaller dose is desirable.

STRAMONIUM.

Jamestown weed, or *Datura stromonium,* is official in the form of the leaves (*Stramonium,* U. S.; *Stramonii Folia,* B. P.). It contains an alkaloid, known as daturine, which is physiologically identical with atropine.

Physiological Action.—(See Belladonna.)

Therapeutics.—The uses of stramomium are identical with those of belladonna. Stramonium leaves in the proportion of 8 ounces (250) to 2 ounces of nitrate of potash (60) afford, when this mixture is burned, an efficacious method of ridding a room of mosquitoes.

Administration.—The extract (*Extractum Stramonii,* U. S. and B. P.), containing about 1 per cent of alkaloids, is used in the dose of $\frac{1}{6}$ to $\frac{1}{2}$ grain (0.001–0.03); and the tincture (*Tinctura Stramonii,* U. S. and B. P.), containing about 0.025 gram of total alkaloids in 100 cc. in the dose of 5 to 30 minims (0.3–2.0). The ointment (*Unguentum Stramonii,* N. F.) is also used for the same purposes as is belladonna ointment. The dose of daturine is $\frac{1}{120}$ to $\frac{1}{80}$ grain (0.0005–0.0008).

STRONTIUM.

This metal has been introduced into medicine in the form of the bromide (*Strontii Bromidum,* B. P.), the iodide (*Strontii Iodidum*) the salicylate (*Strontii Salicylas,* U. S.) and as the lactate and phospate, largely through the studies of Laborde, Sée, Paul and others. Bromide of strontium is used for precisely the same effects as are the other bromides, but it is claimed that, as the strontium is not irritating or depressing, the disadvantages of the potassium salt are avoided by its employment. The dose of bromide of strontium is from 10 to 60 grains (0.65–4.0). In addition to the ordinary effect of bromides, Sée found the bromide of strontium to be useful in overcoming attacks of *gastric indigestion* associated with pain in the stomach and hyperacidity, and the author has confirmed this statement. The lactate of strontium seems to be indicated chiefly in cases of *albuminuria* due to *renal atony.* It does not increase urinary flow, and is said to be contraindicated in the presence of uremia and the high fever of acute parenchymatous nephritis. In *chronic interstitial nephritis,* such as is due to rheumatism or gout, it is said to be of value. Unfortunately, as soon as the lactate of strontium is withdrawn the albuminuria is apt to recur. The writer has often been much disappointed in the use of the lactate of strontium in albuminuria, but others of wide experience seem to regard it as constant in producing good results. The dose of the lactate of strontium is 60 to 100 grains (4.0–6.6) a day. It has also been used with advantage in tetany when it seems to act by conserving the body's supply of calcium.

The salicylate of strontium is a valuable preparation, because it is not so disagreeable to the taste as the corresponding salt of sodium; and, more important still, it is far less apt to disorder the stomach than salicylic acid or any of its other salts. The author has found it for these reasons very useful in *acute articular rheumatism* when the progress of the patient was delayed by the inability of his stomach to retain the ordinary antirheumatic remedies. The salicylate of strontium is best given in capsule or cachet, and should always be followed by a draught of milk or water to prevent its coming in contact with the stomach in too concentrated form. The dose is, for all practical purposes, identical with that of the salicylate of sodium.

Strontium possesses no toxic power whatever, and overdoses are not followed by unpleasant consequences. If the strontium is contaminated by barium, serious effects are produced.

STROPHANTHUS.

Strophanthus, U. S., *Strophanthi Semina,* B. P., is an African plant (*Strophanthus kombé*), from the seed of which the natives make kombé arrow poison. The active principle is a glucoside *Strophanthinum* (U. S.). Although *Strophanthus kombé* is the official plant it has been found that at least twenty varieties of strophanthus are on the market. Only three of these have been carefully studied and most of these investigations have naturally been on the strophanthin derived from *S. Kombé.* These three varieties are *Strophanthus Kombé, Strophanthus hispidus,* and *Strophanthus gratus,* and much of the tincture of strophanthus on the market probably comes from these and other sources. This would be of little importance were it not that even the strophanthin which is obtained from Kombé varies greatly quantitatively and qualitatively. It cannot be tested chemically and Rowe has shown in twenty-two samples tested physiologically there was a variation so great that one was 67 per cent of standard and another 240 per cent of standard. Further than this some samples of strophanthin seem to be absorbed more readily than others. These facts probably account in part for the success of strophanthus in some cases and its failure in others. (See below.)

The active principles of *Strophanthus gratus* is called *Ouabain,* which is sometimes used as a substitute for strophanthin. Some of the ouabain on the market is derived from ouabain wood or from acocanthara woods. This variation in source results in uncertainty as to its strength and militates against the use of the drug. Like Strophanthin it appears on the market in solution in ampoules containing $\frac{1}{120}$ of a grain (0.0005). This dose is the maximum. It should not be repeated oftener than once in twenty-four hours and is given intramuscularly, or intravenously not subcutaneously. Ouabain is not official.

It has been claimed that strophanthus contains a local anesthetic principle, but de Schweinitz and the author found it to be possessed of this power only in dogs, and not in man.

Physiological Action.—Strophanthus acts as a stimulant to the heart muscle, but does not slow the pulse by an action on the vagi, as does digitalis. While it raises arterial pressure by the increased heart action, it does not stimulate the vascular system to any extent. It is, therefore, useful in cases of *weak heart with arterial spasm,* since it helps the heart, but does not increase its work by raising arterial tension.

Therapeutics.—Strophanthus may be used to supplant digitalis in all forms of *cardiac disease,* but it is not its equal, and it is to be recalled that so large a part of the active principles of the drug is destroyed in the alimentary canal that the use of the drug by the mouth is an uncertain method of medication. Furthermore it is very slowly absorbed and so its effects are uncertain, and if the doses are large it is prone to produce an active diarrhea. The fact that the dose of the tincture is about the same as tincture of digitalis, although the amount of strophanthin it contains makes it about one hundred and fifty times as toxic if it is tested upon the frog's heart, proves that only a little of it is really absorbed, and when doses as small as 5 minims (0.3) are given any benefit comes from other factors.

As is well known, there are a certain number of cases in which digitalis fails to do good, the explanation being that under such circumstances the transmission of impulses over the bundle of His is delayed or arrested by its influence. Strophanthus often acts exceedingly well in these instances where digitalis fails. It will relieve *cardiac dropsy* by its action on the heart, but does not possess marked diuretic properties. Intravascular injection of strophanthin is a certain method of getting the effects of the drug, but subcutaneous injection is ill advised, owing to its local irritant effects. Possibly because the heart, under an intravenous injection, gets the whole of the dose used, it is a fact that the effect of the drug so given is very prompt as compared to digitalis. Intravenous injections should, however, be given only in very urgent cases of failing heart.

A very useful preparation is *strophanthone.* It is active and prompt in its effects and should be employed from ampoules containing 2½ minims (0.15) diluted with normal saline to 16 minims (1.0). This may be given hypodermically or by the mouth in the dose of ½ to 1 cc. or intravenously in the dose of ½ cc. One cc. represents about $\frac{1}{65}$ of a grain of strophanthin, so that ½ cc. (about 7 drops) will often be sufficient. Its effects often persist, when given by the needle for twenty-four hours.

Untoward Effects.—Strophanthus when given in full doses by the mouth often causes diarrhea. *It is important to bear in mind that after full doses of digitalis have been given a fatal result may follow the intravenous use of strophanthin.* Several days should elapse after digitalis is stopped before the strophanthin is given. My experience leads to the belief that this danger does not exist if strophanthone is used hypodermically.

Administration.—Strophanthus is given in the form of tincture (*Tinctura Strophanthi*, U. S. and B. P.), in the dose of 10 to 15 minims (0.5–1.0) (5 minims (0.3), B. P.), three times a day. The extract of strophanthus (*Extractum Strophanthi*) is now official in the B. P. The dose is $\frac{1}{4}$ grain (0.015). Strophanthin (*Strophanthinum*, U. S.), may be given intravenously in the dose of $\frac{1}{150}$ grain (0.0004).

SUGAR.

Sucrosum, U. S. (*Saccharum Purificatum*, B. P.), is the refined juice of *Saccharum officinarum*, or sugar cane, or that obtained from *Sorghum*, or from the sugar beet. It is an antiputrefactive, but not an antifermentative. Mixed with iron preparations, it prevents oxidation. As it is a hydrocarbon, it is a nutrient and a developer of adipose tissue, or, in other words, is a food. Its use is contraindicated in obesity, during the existence of fermentative changes in the stomach and intestine, and in diabetes mellitus.

SUGAR OF MILK.

Lactosum, U. S. and B. P., is derived from the whey of cows' milk by evaporation, in the proportion of about 5 per cent, and is then purified by recrystallization. It has little sweetening power compared to cane sugar and possesses a peculiar insipid taste. It is, however, less apt to ferment and is better for infants than is cane sugar.

Milk sugar is largely used in triturations, because by its hardness it aids in the subdivision of the medicament. It is also used to increase the bulk of small powders when such drugs as podophyllin and calomel are prescribed. It is sometimes called *lactose*.

Lactose to be possessed of great diuretic power should be given in full doses. The advantage claimed for lactose as a diuretic is its direct action on the kidney and the slight effect exercised upon the rest of the organism. It is, therefore, in *cardiac dropsy* or *renal inactivity* that this substance is particularly indicated. The dose of lactose in cases of dropsy should be as great as from 2 to 4 drams (8.0–16.0), given daily, dissolved in 1 quart (960 cc.) of water. It has been found that the lactose acts best in those cases in which there is little albuminuria. The diuretic effect is of interest in view of the well-known clinical fact that the too free addition of lactose to the milk of bottle-fed babies always causes profuse diuresis.

SULPHARSPHENAMINE.

Sulpharsphenamine is prepared from arsphenamine, sodium bisulphide and formaldehyde, differing from neoarsphenamine by possessing a side chain containing an additional atom of oxygen. As placed on the market, it appears as a fine powder, slightly yellow in color, and readily soluble in water, making a permanent solution. It contains from 20 to 23 per cent of arsenic, a little more than neoarsphenamine and about 10 per cent less arsenic than arsphenamine. It is one-fourth as toxic as the latter drug, and may be used intravenously and intramuscularly. It is much less irritating when given into a muscle than are the older arsenicals. It is quite as efficient as a spirillicide and on the blood Wassermann reaction as neo- and old arsphenamine, and the fact that it is less toxic and that it can be given intramuscularly, without much reaction is an advantage in that it renders the patient more willing to receive repeated doses. It probably is prone to cause skin reactions more frequently than neo- and old arsphenamine. It seems more useful in neurosyphilis than the older arsphenamines and is particularly indicated when, for any reason, the older drugs cannot well be employed by the vein, as in obese persons, in persons with small and deep-seated veins and in infants. The intramuscular injection can also be used with advantage in pregnant women when intravenous injections are considered unwise. Nitritoid crises have been observed but rarely after its use. It is claimed that the intramuscular injections if given into the supragluteal region are not painful, although if given hypodermically they produce a sense of burning. It seems prone to induce arsenical dermatitis (see Sodium Thiosulphate.), and skin eruptions of various types, scarlatinal or morbilliform, with fever, may appear. These may appear in two hours or not for several weeks. Stomatitis may also develop. Sulpharsphenamine is distinctly contraindicated in the presence of hemorrhagic tendency or in the presence of solutions of continuity which may bleed, such as gastric ulcer and duodenal ulcer.

In *Vincent's angina* sulpharsphenamine is valuable given intramuscularly or even intravenously.

Sulpharsphenamine appears on the market in ampoules containing 0.1, 0.2, 0.3, 0.4, 0.5, 0.6 and 0.9 gram. Usually it is best to begin with the smallest dose and gradually increase it; the course of treatment consisting of 8 injections, covering a period of fourteen weeks.

It is important to remember that the same rules as to asepsis and pure water should be followed as when arsphenamine is administered. It is claimed by some that sulpharsphenamine is singularly efficacious in *chancroid, gonorrheal arthritis, epididymitis, malaria* and even in *smallpox*.

Administration.—Before using the contents of an ampoule it should be dropped in 95 per cent alcohol to determine if the ampoule is perfect. If not, the sample should be discarded. If perfect, the ampoule is wiped dry, opened by means of a file, and then the drug is dissolved in 5 to 10 cc. of sterile freshly distilled water or normal saline, when it is drawn up into a sterile glass syringe and *slowly* injected into a vein. When used intramuscularly the same rules are followed with a much smaller amount of water; thus 0.2 should be dissolved in 0.6 cc., 0.3 in 0.9 cc.; 0.4 in 1.2 cc. and 0.6 in 1.8 cc. After sterilizing the skin with alcohol over the upper part of the buttock the tissues are drawn down toward the thigh with one hand and the needle, attached to the syringe which is already filled with the solution, is pushed into the muscle. The piston is then withdrawn slightly to determine if, by chance, a bloodvessel has been entered. If so, blood will appear in the barrel of the syringe. If not, the injection is proceeded with slowly. Then the needle is withdrawn with a quick jerk, the skin of the buttock being allowed to return to its normal position, thereby acting as a valve. The best needle is one of small size, such as a No. 22-gauge, and in adults should be 2½ inches from the hub to the point.

The best posture for the patient to assume is prone with the toes turned in and the heels out. After the injection the parts should be gently rubbed. If a nodule forms which is painful a hot bath or hot compress may resorted to dissipate it.

It is important that the proportion of water named for intramuscular injection shall not be exceeded.

The injections should be given in courses. In the first course an injection every third day for three doses, then every five or six days for five or six doses. After this no more is given for sixty days, mercury being used. After sixty days repeat the sulpharsphenamine as before. These procedures should be extended over at least a year.

SULPHONAL.

Sulphonmethanum, U. S., *Sulphonalum*, B. P., is a synthetically prepared substance first manufactured in Germany by Baumann, and possesses the chemical name of diethyl-sulphone-dimethyl-methane. It is a colorless, odorless, solid substance, soluble in 365 parts of cold and 16 parts of boiling water. The drug is not affected by any of the ordinary acids and is very stable.

Physiological Action.—In medicinal doses the effect of sulphonal upon the lower nervous system is practically *nil*. The dominant effect is on the brain. The drug is completely changed during its passage through the body. On the circulation the drug has but little effect; upon the respiration it acts as a depressant only when given in very full doses.

Therapeutics.—Sulphonal finds its place in medicine as a somnifacient or hypnotic, valuable when *functional nervous insomnia* is present, useless where advanced disease, such as cardiac trouble, is responsible for the wakefulness. In *insanity* it often produces sleep, and is of great service in the various mental disturbances characterized by lack of sleep and often affecting persons of unsound mind. Sulphonal is not as useful an hypnotic as barbital or barbital sodium.

It possesses sleep-producing power of moderate amount—not equal to chloral, but greater than that of paraldehyde—and it will sometimes succeed where the other hypnotics fail. It has the great advantage of not being a depressant to the heart.

Administration.—Sulphonal being virtually insoluble in cold water, may be given in large capsules or in mucilage of acacia, so as to be held in suspension until swallowed. The insolubility and bulkiness of the drug render its use difficult. It is best given in hot water (about 6 ounces), as suggested by Stewart. This makes a solution, and as soon as the liquid is cool enough to be swallowed it should be taken before precipitation occurs as the result of cooling. Sulphonal should be used several hours—say two or three—before the patient retires. If taken late at night, the patient frequently fails to sleep until the morning hours, and is heavy and drowsy all the next day. This difficulty is partly avoided by the use of a hot solution, but even then it is apt to arise. The dose is 20 to 40 grains (1.3–2.6). It is wise not to use sulphonal continuously for more than a few days.

Untoward Effects.—When sulphonal is taken in full dose for long periods of time, great sleepiness and weariness, with an unsteady gait, develop, which may go on to paralysis of the lower extremities if the use of the drug is persisted in. In some cases the paralysis is progressive, and in others hyperesthesia and abnormal sensations develop. In many such cases there is great disturbance of digestion with scanty secretion of urine, which contains an unusual substance, giving this secretion the color of port wine (hematoporphyrinuria). This is partly due to a cumulative effect of the drug.

Sulphonal often produces mental heaviness and a staggering gait the day after it is taken in a single dose. This can to some extent be avoided by giving a dose of some laxative when the drug is taken, so that the bowels will be moved thoroughly the next morning. There are a number of cases of death on record from acute and chronic poisoning by sulphonal. In both classes of cases the death was by respiratory failure preceded by profound unconsciousness. As much as 120 grains (8.0) have been taken, however, without ill effect, and Neisser has reported a case which recovered after 1400 grains had been taken. Probably but a small amount of this dose was actually absorbed. In cases of subacute or chronic poisoning the prognosis is unfavorable if the symptoms are well developed.

SULPHIDE OF CALCIUM.

(See Calcium, Calx, and Sulphides.)

SULPHUR.

Sulphur is a non-metallic element official in three forms in the U. S. P.—namely, as *Sulphur Sublimatum*, U. S. and B. P., or sublimed or flowers of sulphur; *Sulphur Præcipitatum*, U. S. and B. P., or precipitated sulphur; *Sulphur Lotum*, U. S., or washed sulphur.

Much confusion exists among students as to the differences between these various forms of sulphur. Sulphur itself is an element which is prepared for medicinal uses by being heated and sublimed (*Sulphur Sublimatum*), or flowers of sulphur. *Sulphur lotum*, or washed sulphur, is prepared in order to get rid of sulphuric acid and other contaminating substances, and is made from sublimed sulphur. *Sulphur præcipitatum* is also made from sublimed sulphur, and is more bland and minutely subdivided. Some believe it differs from sublimed sulphur in its therapeutic properties by reason of a small amount of water supposed to be present. It is sometimes called *milk of sulphur*. When sulphur is prescribed for internal use the sublimed sulphur is generally designated.

Physiological Action.—Sulphur has little physiological influence over the general system. When taken internally it causes a soft, mushy stool of a yellow color which often has a strong odor of hydrogen sulphide. The drug acts particularly on the skin and mucous membranes as a gentle alterative. The juices of the intestines break up some of it into sulphuretted hydrogen and sulphides.

Therapeutics.—Sulphur is used as a mild laxative, never as a purge. In *stricture of the bowel* the soft stools produced by it will often slip by the obstruction, and it is worthy of note that sulphur will sometimes overcome constipation when nothing else will give relief. It is particularly valuable in the treatment of *constipation* where there are *hemorrhoids*, and in *chronic rheumatism* and *sciatica* it is thought by some to effect a cure.

Sulphur is of service in the treatment of *chronic bronchial affections*, but for some curious reason its use has become almost obsolete. Graves recommended 5 to 10 grains (0.3–0.6) of sulphur three times a day wherever bronchial secretion was excessive, and found that it rid the lungs of mucus and relieved the *cough*.

The external use of sulphur is very much more important than its internal use, in so far as regards affections of the skin. Of itself, the drug exercises little effect over the cuticle when used in powdered form, but combination with an ointment makes it at once active. Even irritations of the skin may ensue from its constant use in large amount.

In *scabies*, or *itch*, sulphur ointment (*Unguentum Sulphuris*, U. S. and B. P.) is the best remedy we have. The female parasite burrows under the epiderm and deposits the ova as she moves about, while the male does not burrow, but stays on the surface. The ointment will kill him, as he is readily attacked, but the female is protected by her burrowing propensities. To get at her and the ova the burrows must be opened, and this may be accomplished by a thorough soaking of the body with soap and water, thereby softening the epiderm covering the parasite, which can then readily be removed by rubbing the patient with a rough towel. The towel should be boiled at once to prevent its conveying the parasite to others. The ointment, if now applied, relieves the patient almost at once. It is important that the skin be well softened and rubbed, in order to keep open every burrow. The ointment should be allowed to remain on the part all night and be used for three or four nights consecutively.

Young women often suffer from *acne*, particularly about the menstrual epoch, the skin also becoming at this time sallow and muddy. The following ointment is one which is very successful in promoting a cure:

℞—Sulphuris præcipitati . . . . ʒj (4.0)
Adipis lanæ hydrosi . . . . ℥j (30.0).—M.
S.—Apply once or twice daily.

Administration.—Sulphur is given in the dose of 10 to 20 grains (0.6–1.3) three times a day as an alterative, and from 1 to 2 drams (4.0–8.0) at night as a laxative, with a little molasses to form a paste.

A confection (*Confectio Sulphuris*) is official in the B. P., dose 10 grains to 2 drams (0.6–8.0), as is also *Trochiscus Sulphuris*.

SULPHURIC ACID.

Acidum Sulphuricum, U. S. and B. P., sulphuric acid, or oil of vitriol, is a powerful irritant and escharotic, rapidly dehydrating and carbonizing the tissues, causing them to become black. It is the most astringent of the medicinal mineral acids, and when absorbed it unites with bases to form sulphates, and is so eliminated by the kidneys, the lower bowel, and the skin. It coagulates albumin.

Poisoning.—The symptoms produced by poisonous doses are those of a gastro-intestinal inflammation of the most severe type, or the patient may drop to the floor almost at once, owing to collapse dependent upon perforation of the walls of the esophagus or stomach by the acid and its consequent escape into the peritoneal cavity. If the patient lives to the fourth day, the parotid glands may become swollen as the result of stenosis of the salivary ducts of Stenson, and violent inflammation of the kidneys may appear from the passage of the drug through these organs in the process of elimination. If partial recovery takes place, the patient often dies from inanition due to the formation of strictures in the alimentary canal or to destruction of the peptic tubules. The stain about the mouth is black, and if any of the acid is spilt on the clothing, the characteristic burn is to be seen.

The treatment consists in the use of alkalies, such as chalk, magnesia, whitewash off walls, and soap. Opium and oils are to be given to allay irritation, and external heat is to be applied.

Therapeutics.—Sulphuric acid is sometimes employed as a caustic to *venereal sores, warts,* and *slowly healing ulcers,* but is most commonly used internally, as it fulfils several pressing indications. As a remedy for *serous diarrhea*, particularly if combined with some vegetable astringent, it is unsurpassed, and its use in *cholera* deserves great attention. (See Diarrhea.) In the Philadelphia Hospital during an epidemic of cholera some years since every patient who received sulphuric acid improved or failed to be attacked, whereas those who did not receive it were either very ill or died.

The proper way to use the drug as a prophylactic during *cholera* epidemics is in the form of "sulphuric-acid lemonade," made so that each wineglassful of water contains 5 drops (0.3) of the aromatic sulphuric acid. The same solution may be used in *acute lead poisoning* in order to form an insoluble sulphate of lead, and may be taken by artisans exposed to chronic lead poisoning as a prophylactic for the same purpose.

Sulphuric acid combined with belladonna or atropine is often used in the *night-sweats of phthisis.*

Administration.—The dose of the dilute acid (*Acidum Sulphuricum Dilutum*, U. S. and B. P.), is 5 to 20 minims (0.3–1.3), and of the aromatic acid (*Acidum Sulphuricum Aromaticum*, U. S. and B. P.) 5 to 20 minims (0.3–1.3). The latter is the best preparation for general use. It contains tincture of ginger and oil of cinnamon. Both preparations should be thoroughly diluted before they are administered and taken through a tube.

SUPRARENAL GLAND AND ADRENALIN.

The dried suprarenal gland, *Suprarenalum Siccum* or its active principle, *adrenalin* (*Epinephrina,* U. S., *Adrenalinum*, B. P.), has become one of our most valued remedies. Its chief use in medicine depends upon its extraordinary power of producing contraction of small bloodvessels and capillaries with which it is brought in contact. It also exercises a marked constricting effect on the bloodvessels of the general arterial system when given intravenously but chiefly affects the vessels in the splanchnic area. (See below.)

The medullary portion of the glands is chiefly concerned with the elaboration of the active physiological principle, which was isolated by a Japanese chemist, Takamine, and called *adrenalin.* Two types or forms of adrenalin may be isolated from the suprarenals. Although chemically identical they are not therapeutically identical. One rotates polarized light to the right. This dextrorotary type is inert. The levulorotary type is the efficient form. Adrenalin occurs in tiny, almost microscopic, white crystals of various forms. As adrenalin is not readily soluble in water, adrenalin chloride is always employed and appears on the market in solution in the strength of 1 to 1000 (*Liquor Epinephrinæ Hydrochloridi,* U. S.). As this strength is too great for local application in most instances it is further diluted before use by water or salt solution, even to 1 in 20,000.

These dilute solutions are readily oxidized if exposed for a length of time to the air. If the 1 to 1000 solution is colorless it is of full strength; if faintly pink the loss is slight, and when very pink equals about 90 per cent. If it is brown in hue it is only equal to 50 per cent, and if a precipitate is present it should not be used. When in ampoules adrenalin chloride solutions can be sterilized by boiling without any loss of activity. In unsealed solutions exposed to the air such solutions can be sterilized by boiling once or twice without loss of power.

It has been generally considered that adrenalin given by the stomach is destroyed and has practically no effect on the general system, but this has recently been denied, for it is active when given by the mouth in patients with insufficient suprarenal secretion. Unna advises that when given by the mouth the following prescription be used since the dextrose seems to protect the adrenalin from destruction. (See Dextrose.) To be effective on the general system, however, it must be used intravenously or hypodermically. Its physiological effects as secreted by the suprarenal bodies are somewhat different from those when it is injected *en masse*. Thus when secreted freely it causes a flooding of the blood with stored glycogen and thereby provides the muscular system with more food when it is needed; it increases the flow of blood to the heart, lungs, central nervous system and the limbs and at the same time diminishes the blood supply to the digestive organs. While these are its chief physiological effects when secreted they are rarely sought for when the substance is used as a therapeutic agent, except to combat the *hypoglycemia of excessive insulin therapy*.

The following may be said to be physiological effects when it is used medicinally either locally or by the needle.

When locally applied to mucous membranes extract of this gland, or adrenalin, produces great blanching by reason of its powerful constriction of the capillaries of the part. So great is this constriction that the superficial tissues are practically bloodless while its influence lasts. This local effect is due to stimulation of the muscular fibers in the bloodvessel walls. The brevity of these effects when given intravenously is not due to a rapid destruction or elimination of adrenalin, but rather depends upon its inability to maintain its primary influence. This is proved by the fact that if the bloodvessel going to a limb is ligated, thereby cutting off its blood supply, and adrenalin is injected into the vessels of the rest of the body, it causes a brief contraction of all the bloodvessels except those in the ligated part. If after its effects upon the general vascular system have disappeared, the ligature is removed, so permitting the blood to enter the limb, the bloodvessels in the hitherto protected part undergo powerful constriction, which proves that there is still active adrenalin in the circulating fluid. The constriction of the bloodvessels is due to the action of the drug on the vessel walls and not to a centric vasomotor influence.

Adrenalin when given intravenously, or hypodermically, varies in its effects on the circulation with the size of the dose and the state of the heart muscle. Its primary effect, which is prompt, consists usually in a sharp rise of blood-pressure due to its effects on the muscular coats of the arterioles. This brief effect is followed by a fall which may be to a point below the original level. The rise of pressure reflexly increases the influence of the vagi and so the heart is slowed for a brief period without there being any true stimulation of these nerves. This slowing is almost immediately replaced by a quickening of the pulse-rate due to stimulation of the accelerators at their termini in the heart muscle. This is its dominant influence. The cavities of the heart are completely emptied but if the dose be very large the cardiac output is diminished because diastole is shortened. The irritability of the heart muscle is increased but it is questionable if its contractile power is augmented. This increased irritability and accelerator stimulation may result in great cardiac arrhythmia due to premature contractions arising in the atrio-ventricular node or in the walls of the ventricles and may also cause auricular premature beats. In other instances paroxysmal tachycardia may develop or instead auricular fibrillation particularly in elderly persons. Ventricular fibrillation sometimes occurs. It is evident, therefore, that adrenalin must be used with caution particularly in the presence of disease of the heart muscle as in acute illness such as pneumonia, typhoid fever or in myocardial degeneration. It is interesting to note that adrenalin may on the one hand do good and on the other do harm in an emergency. (See paragraphs dealing with its therapeutics.)

It is important to recall the fact that the pulmonary vessels are not affected by adrenalin, and that even the direct application of this substance to the lung does not cause local ischemia. Although it constricts the fibers of the systemic bloodvessels it relaxes the bronchial muscularis. Further, the constricting effect on the vessels of the cerebrum is very slight. The vessels of the uterus are strongly affected, but those of the bladder are but slightly influenced.

When injected in full dose beneath the skin or into a vein adrenalin may cause a temporary glycosuria in many cases because the blood is flooded with sugar.

Therapeutics.—Because of its extraordinary power in constricting bloodvessels of small caliber adrenalin is a remedy in all forms of *hemorrhage* from such vessels, if it can be locally applied.

Thus, it can be employed locally in *epistaxis, menorrhagia, metrorrhagia,* and for the purpose of controlling hemorrhage in operations on the nose, throat, ear, or larynx. It can also be employed to relieve the *engorgement* of the *nasal mucous membrane* in cases of *asthma, coryza,* and *hay fever,* and in *trachoma* and *conjunctivitis.*

An acute attack of *bronchial asthma* can generally be rapidly and completely relieved by the hypodermic injection of 5 to 10 minims (0.3–0.6) of adrenalin solution, 1 to 1000 strength (*Liquor Adrenalini* *hydrochloridi*, B. P. This is due to the fact that adrenalin relaxes the muscular fibers of the bronchi. In *sudden cardiac failure* and *collapse* complicating surgical procedures, a pint of normal saline solution may be slowly injected into a large vein, and in this solution, as it flows into the vessel through a rubber tube and needle, should be placed 30 minims (2.0) of adrenalin solution (1 to 1000). Cases apparently moribund have been resuscitated by this means. Under these circumstances the vasomotor center is depressed or paralyzed and death ensues because of the vascular relaxation. The use of strychnine for the purpose of stimulating the vessels through the vasomotor center is often useless because it is too depressed to respond. The intravenous injection of adrenalin acts directly upon the muscular fibers in the vessel walls and raises blood-pressure so that life is saved.

So, too, it may be injected directly into the heart muscle with hope of recovery in infants seemingly born dead, and in sudden collapse threatening death during surgical procedures and in acute disease when death seems imminent. The point of injection is designed to carry the drug into the wall of the left ventricle, namely, in the fourth or fifth interspace, or, if the heart be very much dilated, in the sixth interspace, one finger-breadth inward from the left border of relative heart dulness. The needle should be introduced gently upward and inward when it can be felt engaged in the heart muscle. If it is desired to reach the right ventricle the puncture should be made in the fourth intercostal space at the upper margin of the fifth rib close to the sternum. By these measures we avoid injury to the upper two-thirds of the sulcus longitudinalis anterior, the atrio-ventricular septa, the bundle of His and the coronary vessels. So, too, by keeping close to the sternum, the internal mammary artery is avoided, because at this point it is about 15 mm. from the edge of the sternum. The quantity injected is 0.5 to 1 cc. of a 1 to 1000 adrenalin solution. To be efficient the giving of the injection must not be too long delayed, not only because the heart may not recover, but also because the vital centers suffer irreparable damage if deprived of blood for a very short period. It is also very valuable when given hypodermically in *anaphylaxis*.

Clinical experience indicates that the hypodermic injection of adrenalin in the dose of 5 to 10 minims (0.3–0.6) of the 1 to 1000 solution is the most effective treatment for attacks of *heart-block* or *Stokes-Adams syndrome*.

At first sight these uses of adrenalin, which have proved of service in clinical medicine and surgery, seem in direct contradiction of some of the facts described when discussing its physiological action. In reality the seeming contradiction is explicable. The explanation of its use in heart block lies in the fact that when the impulses from the sino-auricular node cannot reach the ventricle the adrenalin stimulates the centers in the ventricular wall to activity, which is what occurs in those untreated cases of block that survive an attack of heart block. When given by intracardio-cardiac injection it increases the irritability of the cardiac muscle and so starts it going again and its effect on the accelerators causes the heart to pick up speed. On the other hand in the presence of acute infection, or its results, as in typhoid fever or pneumonia when there is evidence of cardiac failure it may be *distinctly dangerous* for reasons given, particularly if the pulse is irregular. This is also true in the presence of old myocardial damage and cases are recorded in which its use in these two types of cases have resulted in such cardiac arrhythmia or disordered beats as to produce fatal results.

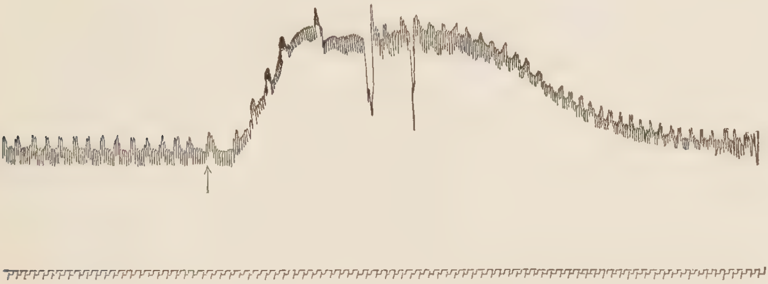


FIG. 63.—Showing the rise of arterial pressure produced by the injection of 0.00004 of adrenalin into the vein of a dog.

Recent investigations have seemed to show that adrenalin very distinctly increases the tendency to the ventricular fibrillation which is induced by chloroform, and it would seem to be proved that after adrenalin has been used locally or hypodermically, chloroform as an anesthetic is distinctly contraindicated.

Strong solutions must be used with care when given hypodermically in blood stream infections, because they cause ischemia of the part injected, and this, in turn, permits germs to grow, and so a slough may ensue.

Adrenalin is largely and wisely used in association with local anesthetics, such as cocaine, etc., to increase their local effect by confining them to the part to which they are applied, since it greatly diminishes the danger of their absorption into the system by diminishing the blood supply of the part.

Certain clinicians also assert that the injections of 5 to 15 minims (0.3–1.0) of adrenalin solution, 1 to 1000, into inoperable sarcomatous and carcinomatous growths results in a marked arrest in the development of the tumor and in a gain in weight on the part of the patient. If the injection causes pain it may be preceded or accompanied by procaine. In *pernicious vomiting of pregnancy,* without albuminuria, 20 minims (1.3) of the 1 to 1000 solution in salt solution may be given hypodermically with advantage in some cases. It is also useful for the temporary relief of severe *urticaria* in doses of 5 to 10 minims by the needle.

Adrenalin may be given internally in solution to check *hemorrhage from the stomach,* but if it is being used in a case of shock its action by this method is too feeble for the gastric juice certainly diminishes its activity or destroys it before it can be absorbed. When used locally it is employed by wetting a pledget of cotton with the solution named and then pressing it lightly against the part which it is desired to affect. Blanching comes on in a few moments. A solution of 1 to 10,000 or stronger may also be brought in contact with the part by means of an atomizer.

Adrenalin is largely used by general surgeons and by rhinologists in combination with procaine or cocaine to prevent the absorption of the latter drugs by constricting the local vessels. By this interference with absorption its local effect is also increased. Under the name Adrocaine a mixture of adrenalin and procaine appears on the market in various strengths in tablet form ready to be dissolved, and in 2 ounces (60.0) rubber-stoppered vials containing procaine 1.05 per cent and adrenalin 1 to 100,000.

Adrenalin has been used in the dose of 0.5 cc. of the 1 to 1000 solution, given hypodermically, to aid in the diagnosis of early hyperthyroidism. The blood-pressure and pulse-rate is taken before the injection and thereafter every three minutes over a period of ninety minutes. If there is hyperthyroidism the pulse-rate and pressure often rise about ten points within the first fifteen minutes with heart consciousness, a feeling of dread, tremor, pallor and flushing with some sweating. This so-called Goetsch test has been used in separating the fag of early tuberculosis from the condition in which too great activity of the thyroid exists. Unfortunately the test often fails, and Sandiford, in her studies with the metabolimeter of the effects of adrenalin when given for this purpose, concluded that there is no sound physiological reason for the assumption that the character of the reaction is indicative of hyperactivity of the thyroid gland.

The Loewi test consists in dropping into the eye 1 or 2 drops of the 1 to 1000 solution of adrenalin, when if there be *pancreatic insufficiency* the pupil will dilate.

Pilcher has seemed to prove that that its action when given intracutaneously is more prompt than when it is used hypodermically or intramuscularly.

As stated on a preceding page, Unna recommends the following prescription if adrenalin is given by the mouth:

℞—Liquor adrenalini hydrochloridi		fʒv (20.0)
Dextrose		℥j (30.0)
Syrupi acid citrici		fʒij fs (10.0)
Aquæ destillatæ	q. s. ad	fʒiij (90.0)

M.—S. One teaspoonful before meals three times a day.

It is noteworthy that when adrenalin is given hypodermically and its effects begin to wane that they become active again if the part injected is rubbed. This is probably due to the fact that the contraction of the vessels at the point of injection prevents absorption of the whole dose which takes place when local circulation is restored.

Untoward Effects. -Very rarely when adrenalin is used hypodermically it causes a sense of weakness in the knees, a fine tremor in the hands and a slight sense of apprehension. These symptoms pass off very rapidly.

In aged persons with feeble hearts and in those subject to cardiac arrhythmias, particularly during the acute infections, adrenalin may induce fatal ventricular fibrillation or other serious cardiac disorder.

Administration.—Suprarenal gland may be given in desiccated form in the dose of 3 to 10 grains (0.2–0.6), or as an extract of the gland, in the dose of 3 to 5 grains (0.2–0.3) three times a day or oftener. As already stated its effects when given by the mouth are practically *nil.* By far the best form in which to use it is adrenalin chloride in normal salt solution, 1 to 10,000 to 1 to 1000 (*Liquor Adrenalinum Hydrochloricus,* 1 to 1000, B. P.).

SWEET SPIRIT OF NITRE.

Sweet spirit of nitre (*Spiritus Æthylis Nitritis,* U. S. and B. P.), or spirit of nitrous ether, is a mixture of alcohol, water, and ethyl nitrite. Spirit of nitrous ether should contain not less than 3.5 per cent of ethyl nitrite. It is upon this last constituent that most of its value as a remedial agent depends. The drug when sold by pharmacists or others who are not careful to keep fresh preparations is no better than alcohol and water alone, since the ethyl nitrite readily escapes, and deterioration at once takes place. When freshly prepared and medicinally active this preparation should, as its name indicates, be sweet in taste. If it is acid, turns blue litmus red, or effervesces on the addition of bicarbonate of potassium or sodium it should be rejected. When sweet spirit of nitre is impure because of the presence of free acid, and is mixed with antipyrine, a purple color followed by a green precipitate will be formed. This green precipitate is iso-nitroso-antipyrine, which is not in the least poisonous, but such a sample of nitre should be discarded.

Physiological Action.—Sweet spirit of nitre is a sedative to the circulatory and nervous systems, as are all the nitrites (see Nitrite of Amyl) and a diaphoretic and diuretic, according to the manner in which it is administered. If given in very full doses, it rapidly produces the cyanosis characteristic of the full effects of any one of the nitrites. (See Amyl Nitrite.)

Therapeutics.—There is probably no drug so widely employed by the laity as a household remedy which is so potent for good, and yet so harmless, if wrongly used, as is this one.

Physicians often place less reliance upon it than it deserves, and in nearly every instance where it fails it is either not indicated or the nitrous ether has escaped and left it powerless.

In *incontinence of urine* in children the combination which follows is very useful in certain cases. (See also Incontinence of Urine, Part IV.) In these instances the urine will be found high-colored, acid, and concentrated, and therefore capable of irritating the bladder and genito-urinary tract:

℞—Potassii citratis . . . . ʒj to ʒij (4.0–8.0)
Spiritus ætheris nitrosi . . . . f℥ss (16.0)
Aquæ destillatæ . . . . q. s. ad f℥iv (120.0).—M.
S.—Dessertspoonful (8.0) every five hours until the urine becomes clear.

As soon as the urine is clear and neutral, belladonna may be used, the citrate of potassium and sweet spirit of nitre being continued or not as the case demands. When the spinal centers are depressed and there is general atony of the system, it may be well to substitute the following pill for the belladonna:

℞—Arseni trioxidi . . . . gr. $\frac{1}{6}$ (0.012)
Extracti nucis vomicæ . . . . gr. ij (0.12)
Quininæ sulphatis . . . . gr. xx (1.3).—M.
Fiant pilulæ, No. xx.
S.—One pill t. i. d. after meals.

The diuretic action of sweet spirit of nitre is best obtained by using the drug in ice-cold water and keeping the patient lightly covered and cool. On the other hand, if a diaphoretic influence is desired, it may be given simultaneously with warm lemonade, and the patient should be well blanketed. This last action of sweet spirit of nitre has made it a remedy of common use in treating *acute colds* in adults and children, and in diminishing the fever of these conditions in the latter class as well.

Sweet spirit of nitre is a distinct antispasmodic, and can be well employed where slight *nervous excitement* accompanies fevers or in other states associated with nervous irritation in infancy.

The dose for an adult is from 20 minims to 2 drams (1.3–8.0), and for a child of one year 5 to 10 minims (0.3–0.6). It should always be given in cool water to the latter class of patients.

TANNIC ACID.

Tannic acid (*Acidum Tannicum,* U. S. and B. P.) when pure is an uncrystallizable, white or yellowish-white powder, without bitter taste and very soluble in water and glycerin. It is not soluble in alcohol or ether. It is the chief active principle of vegetable astringents, and occupies the relative position of an alkaloid to a crude drug, so far as the active portion of these vegetable astringents is concerned. Tannic acid is derived from nut-gall.

Physiological Action.—Tannic acid when brought in contact with any of the tissues of the body constringes them and decreases their vascularity for a time, by causing contraction of their bloodvessels. For these reasons it stops secretion and constringes parts of the body which are relaxed and feeble. Mixed with blood, it forms a clot with great rapidity through coagulation of the albumin. Tannic acid is absorbed as gallic acid and eliminated as such, only acting as tannic acid before absorption. This is important to remember, since we learn from this that tannic acid is to be used to check hemorrhage only where the drug can be brought in direct contact with the bleeding point.

Therapeutics.—Tannic acid is used in medicine to control *hemorrhage,* and to act as an astringent to relaxed tissues, as in *diarrhea* of the atonic or serous type, or in localized or general *sweating.* It is also of service for the purposes of toughening mucous membranes or parts of the skin which are exposed to much rubbing, as in the case of the nipples of a primipara, or where the feet become macerated and sore or sweat profusely on exercise being taken. (See Formaldehyde.) In the treatment of *hemoptysis* tannic acid has been dissolved in water in the proportion of 5 to 10 grains (0.3–0.6) to the ounce (30.0) and used in a fine spray delivered from an atomizer, but it is of little or no value because it does not reach the bleeding point. (For the use of tannic acid in burns see Burns, Part IV.)

Glycerite of tannin is made by adding 2 ounces (60.0) of tannic acid to a ½ pint (240 cc.) of glycerin, and mixing at a gentle heat until solution occurs. It is useful as an application to *indolent ulcers* and *depressed mucous membranes,* as after an attack of stomatitis. In *hemorrhoids* of the bleeding type tannic-acid suppositories are often very useful, and cotton saturated with tannic-acid solution is often used as a packing in *vaginal leucorrhea.*

Administration.—The dose of tannic acid is 2 to 10 grains (0.12–0.6), best given in pill. The official preparations are—the troches (*Trochisci Acidi Tannici,* U. S.), each containing 1 grain of tannin; the *Glyceritum Acidi Tannici,* U. S.; *Collodium Stypticum,* U. S.; and an ointment (*Unguentum Acidi Tannici,* U. S.). The B. P. preparations are—*Glycerinum Acidi Tannici; Suppositoria Acidi Tannici,* each containing 3 grains (0.20); and *Trochiscus Acidi Tannici,* of which each contains ½ grain (0.30) of the acid.

TAR.

(See Pitch, p. 466).

Under the name of *Pix Pini,* U. S. and B. P., or tar, we have an empyreumatic oleoresin obtained by destructive distillation from *Pinus palustris* (*Sylvestris,* B. P.) and other varieties of pine. It is a thick, dark oil, slightly soluble in water and soluble in alcohol, oils, and solutions of potassa and soda. By distillation of tar we obtain oil of tar (*Oleum Picis Rectificatum,* U. S.), which is used in *bronchitis* by inhalation from an atomizer, but is not a particularly useful application. It should be diluted with some other oil or with liquid petrolatum. Tar itself is used in *subacute and chronic bronchitis* in 2-grain (0.12) pills, and as a remedy for *gastro-intestinal catarrh.* Externally, it is used in *psoriasis* and other skin diseases needing stimulation. For the relief of *obstinate diarrhea* Wood has highly recommended a mixture of tar made as follows: Add a pint of tar to a gallon of lime-water, and allow this solution to stand one week, stirring it every few hours. Decant the clear liquid and percolate it through powdered wild-cherry bark, allowing 1 ounce of the bark to be present for each pint passed through it. The dose is a wineglassful (60.0).

In *chronic bronchitis* tar-water is largely used, as a popular remedy, in Europe and England. Tar-water is made by shaking 1 part of tar with 4 parts of water several times during twenty-four hours, decanting, and filtering. The dose is from 1 to 2 pints (½–1 liter) a day as a drink. It at first increases the expectoration, but finally decreases it.

Syrup of tar (*Syrupus Picis Pini,* U. S.) is simply sweetened tar-water.

In *skin diseases* of the dry, scaly sort, such as *psoriasis,* tar ointment (*Unguentum Picis Pini,* U. S. and *Liquidæ* B. P.) is very useful if frequently applied, or the following may be used:

℞—Sulphuris præcipitati,		
Picis liquidæ	āā	ʒvj (24.0)
Saponis viridis,		
Adipis	āā	℥ij (60.0)
Pulveris cretæ		ʒiv (16.0)

If the skin is tender, this prescription should be diluted with lard. Sometimes children will suffer from a persistent *dry chronic eczema* which resists all treatment; the following may then be employed with advantage.

℞—Picis liquidæ	ʒss (2.0)
Sulphuris præcipitati	ʒss (2.0)
Unguenti zinci oxidi	℥j (30.0)

S.—Apply night and morning.

Tar should not be used on the face, as it will stain the skin.

Wine of tar (*Vinum Picis*) is made by adding together tar 1 pint, glycerin, white wine, and honey of each ½ pint, dilute acetic acid 1 ounce, and 3 parts of boiling water, and shaking constantly at a temperature of 160° F. for several hours. This mixture is then set aside for some days and repeatedly filtered or strained through muslin. The dose is 1 to 4 ounces (30.0–120.0). It may be used instead of tar-water or tar-syrup.

TARTARIC ACID.

Acidum Tartaricum, U. S. and B. P., is derived from crude potassium bitartrate, and is much less powerful than acetic acid, but capable of producing very severe gastro-enteritis if taken in overdose and in concentrated form. It is rarely used alone, and is most commonly employed to act upon sodium or potassium bicarbonate to form effervescent drinks. (See Seidlitz Powder and Effervescing Draught.) The dose is 5 to 10 grains (0.3–1.3).

When tartaric acid is taken in poisonous dose, lime-water, alkalies, and magnesia are the antidotes, and opium is to be given to allay irritation. If necessary, emetics are to be used.

TEREBENE.

Terebenum, U. S. and B. P., is a clear, thin, colorless liquid, slightly insoluble in water, having a peculiar odor like that of new pine sawdust and is made by the action of sulphuric acid upon oil of turpentine, which is then distilled at about 160° F.

Therapeutics.—Terebene is a useful stimulating expectorant, in the late stages of *acute* or in *chronic bronchitis* to liquefy and get rid of the mucus which is clogging the bronchial tubes. The drug may be given by way of the stomach or by inhalation. A useful mixture in the later stages of *bronchitis* when the mucus is very thick and tenacious is one composed of equal parts of terebene, iodide of ethyl, and chloroform, placed on a sponge and held some 2 or 3 inches from the face. It has also been employed in *genito-urinary inflammations* of a subacute or chronic form in place of oil of sandalwood or copaiba as a stimulant. In *fermentative dyspepsia* it is of service as an antiseptic. The drug should always be given in capsule in the dose of 5 to 10 minims (0.3–0.6), or by dropping it on sugar in the same amount. This dose may be repeated every three hours. Unfortunately, terebene is very apt to irritate the stomach or to produce diarrhea, and it sometimes irritates the kidneys.

TERPINE HYDRATE.

Terpine hydrate (*Terpini Hydras,* U. S.) is prepared by a process, unnecessary to explain here, from a mixture of pure oil of turpentine, alcohol, and nitric acid. In this manner large colorless crystals, nearly odorless and with a faint taste, are formed, and in this form the drug appears on the market. Terpine hydrate is soluble in 200 parts of cold, 34 parts of boiling water, and in 13 parts of alcohol. Of ether it requires 140 parts for its solution, and of chloroform 135 parts.

Therapeutics.—Terpine hydrate is used for the purpose of increasing secretion from pharyngeal, laryngeal, and bronchial mucous membranes, and is a useful remedy in subacute or *chronic bronchitis* to rid the tubes of mucus. The drug has also been satisfactorily employed in the treatment of *hay fever* when given in full doses. The remedy, while useful in only a limited number of conditions, certainly seems to be very useful in the diseases named. The dose as generally given is 2 to 3 grains (0.12–0.2), but it may be given in the dose of 15 to 20 grains (1.0–1.3) three times a day in *hay fever*. Terpine hydrate may be prescribed in pill, capsule, and in alcoholic solution flavored with some of the aromatic waters and with the addition of a little syrup. Thus:

℞—Terpini hydratis . . . . gr. lxxv (5.0)
Spiritus vini gallici . . . . f℥ij (60.0)
Syrupi lactucarii,
Syrupi tolutani . . . . āā f℥iij (90.0).—M.
S.—1 to 2 dessertspoonfuls (8.0–16.0) three or four times a day.

Or we may prescribe—

℞—Terpini hydratis . . . . gr. xl (2.6)
Acidi benzoici . . . . gr. xl (2.6)
Codeinæ . . . . gr. v (0.3).—M.
Fiant pilulæ, No. xx.
S.—One pill three or four times a day.

An elixir of terpine hydrate with codeine is now widely sold, and is a useful preparation to act as an expectorant and allay excessive cough. This preparation is contained in the National Formulary under the name of *Elixir Terpini Hydratis cum Codeina.* Each dram (4 cc.) of it contains 1 grain (0.06) of terpine hydrate and $\frac{1}{24}$ grain (0.004) of codeine; the dose is 1 to 2 drams (4.0–8.0 cc.) every three hours.

The nitric acid test for albumin in the urine is fallacious if the terpine hydrate is being taken.

TERPINOL.

Terpinol is derived from terpine hydrate by boiling the latter with dilute mineral acids. Terpinol is an oily substance with an odor resembling that of hyacinths. It is almost insoluble in water, but dissolves readily in ether and alcohol. It is used for the same purpose as terpine hydrate, in the dose of 8 to 20 grains (0.5–1.3), in capsule or pill. This dose may be given twice or thrice a day. The drug may irritate the stomach and kidneys when given in overdose.

TETRAIODOPHENOLPHTHALEIN SODIUM.

This salt being eliminated by the liver in the bile is used to determine the state of the gall-bladder by the aid of the roentgen-rays. It often bears the trade name of "Iodeikon." To obtain an adequate picture of the gall-bladder there are at least five necessary factors involved: (1) The dye must be absorbed with fair promptness, (2) the liver must be healthy enough to eliminate it into the bile, (3) the cystic duct must be open, (4) the common duct must also be patulous, (5) ability of the gall-bladder to concentrate its contents. In health this dye when excreted by the liver appears in the gall-bladder and so casts a shadow, but if the cystic duct is occluded the bile laden with the dye cannot enter that viscus and no shadow appears. It may also be used to study the movements of the gall-bladder and to determine deformities in it due to adhesions or other causes.

As tetraiodophenolphthalein sodium is irritating to the gastric mucosa and may cause vomiting it may have to be given intravenously. The customary method of dosage is to administer it after a light evening meal: the dose of an adult being 3.5 to 4.0 grams depending on the weight of the patient. The drug is dissolved in 1 ounce of water and when about to be taken this solution is added to 4 ounces (120.0) of grape juice. This mixture should be taken at once before precipitation takes place. Another method is to divide the intended dose into 6 capsules placing with it in each capsule 2 grains (0.12) of agar and 2 grains (0.12) of sodium bicarbonate. Prepared in either way the dose should be taken within one hour after a light evening meal. The next day before either breakfast or luncheon roentgen-ray pictures are taken at about 9 A.M., 1 P.M., and 5 P.M., or oftener.

A method which does not disturb the stomach is the intravenous injection of the drug, in which case the dose must never exceed 0.055 per kilogram of the patient's weight, that is to be over 3.5 grams. The drug is dissolved in 1 ounce of freshly distilled water, filtered through filter paper and the solution is then sterilized by placing the container in a water-bath which is brought to the boiling-point and kept there fifteen minutes. Now dilute with 150 cc. of sterile normal saline and inject intravenously very slowly, taking fifteen minutes. The primary solution may however be given by a syringe if the strength is not in greater concentration than 8 per cent, the same time being allowed to elapse. It is important that every precaution be taken to prevent any of the fluid entering the perivascular spaces, lest a slough occur, and before the needle is removed some normal saline should be injected to rid the needle of the drug.

When the intravenous method is employed the dose is usually given in the morning before breakfast and no luncheon is taken. The roentgen-ray examinations are made at intervals of four hours up to twenty-four hours if need be. This intravenous method cannot be used in the presence of cardiac degeneration and renal disease of advanced form, or if the patient is markedly jaundiced.

The dye in the gall-bladder in a normal patient usually disappears in three hours escaping through the cystic and common duct, particularly if a light meal of cream and cereal is taken.

If gall stones are present which contain much calcium they are readily seen, but if they consist chiefly of cholesterol they look like filling defects of the gall-bladder. The dye may show the viscus displaced or deformed. If the cystic duct is obstructed there will be no shadow in the first picture. If not blocked there will be a shadow at the first ray which largely disappears on the second roentgen-ray examination after food. No food should even be seen or smelled during the test as the gall-bladder may contract and expel its contents under such stimulation and so give the impression that the dye has not entered it. Too much reliance should not be placed on one test. The failure of this test is not infallible evidence of gall-bladder disease because, as intimated above, extensive disease of the liver, or great hepatic congestion, may prevent elimination of the dye. Occasionally the test fails in catarrhal jaundice.

Under the name Iso-Iodeikon (Phenoltetraiodophthalein sodium) a newer preparation which is said to be effective in two-thirds of the dose of Iodeikon has been introduced. In it the iodine molecules are attached to the phthalein group instead of to the phenol group. It is used not only to visualize the gall-bladder but to study liver function by the appearance of the dye in the blood serum. The dose of iso-iodeikon is about two-thirds that of iodeikon namely 0.004 per kilo, and never more than 2.5 grams at a single dose. It is given intravenously, after preparation as described above and while fresh.

Much credit must be given Graham and his co-workers for the development of these important tests.

THALLIUM ACETATE.

This very toxic drug has been found of definite value when given internally in the treatment of *ring-worm of the scalp.* If care is taken to fit the dose to the size of the child it is reasonably safe. The standard dose is not more than $\frac{1}{8}$ grain for each $2\frac{1}{2}$ pounds (0.008 per kilo). *Not more than one dose* is given, dissolved in $\frac{1}{2}$ glass of sweetened water, before breakfast. After eighteen days the infected hairs fall out and can be aided in removal by applying and removing a strip of adhesive plaster. New hair rapidly grows. For this reason it is important to remove all diseased hair as soon as possible.

An overdose causes pains in the joints and muscles, tachycardia and anemia. Acute infectious fevers and renal disease contraindicate its employment. If given in over dose it is fatal in effect.

THAPSIA.

Thapsia garganica is an umbelliferous plant of Southeastern Europe, employed for the purpose of producing a blister. It is generally used under these circumstances in the form of a plaster. The resin, obtained from the bark of the root, is the form in which it appears in medicine. When applied continuously it produces great irritation, and finally sloughs result.

THEOCIN.

Theophyllina, U. S., or Theocine is a minor alkaloid found in tea leaves. It is insoluble in water, somewhat irritant to the stomach, and is a dimethylxanthin in distinction from caffeine or theine, which is trimethylxanthin.

Because of its insolubility, *acet-theocin-sodium* has been made from a synthetic theocin, as it is soluble in 25 parts of water and contains 65 per cent of theocin. Acids and acid fruits are not to be given with acet-theocin-sodium as they will precipitate theocin.

Physiological Action.—The chief influence of this drug is exercised upon the secreting epithelium of the kidney, upon which it acts as a stimulant and if the kidney be inflamed as an irritant. It is therefore to be used with caution in acute nephritis if at all.

Therapeutics.—The best effects of acet-theocin-sodium are produced in the relief of *cardiac dropsy*, in which state it is said to often cause profuse diuresis. It does much less good in renal dropsy. As its effect on the heart is slightly stimulant it aids diuresis by increasing circulatory activity. Unfortunately, the drug loses its effects after it is used for four or five days. It should be stopped for several days and then given again. The dose is 2 to 3 grains (0.1–0.15), dissolved at each administration in pure water and given twice or thrice a day after food.

Under the name *Metaphyllin*, at one time called *Euphyllin*, a combination of theophyllin and ethylenediamine is sometimes employed not only as a diuretic but also in *angina pectoris*, particularly that type associated with high arterial tension, since it is supposed to relax the coronary arteries. Those who use it most claim that in cases of failing heart characterized by congestive symptoms it is an important aid to digitalis in giving relief on the ground that by increasing blood flow through the coronary arteries it supplies the heart muscle with more blood while under the influence of the fox-glove. The ordinary dose for this purpose is 1 to 5 grains (0.06 to 0.3) three times a day after food. It is less prone to irritate the stomach than theocin.

THIOCOL.

Thiocol is derived from guaiacol, the chief active ingredient of creosote, and is, technically speaking, potassium guaiacol-sulphonate. It is a white fine, crystalline powder, readily soluble in water and in diluted alcohol, and possessing a slightly bitter, salty taste. Thiocol is used in medicine as a substitute for creosote, and guaiacol in the treatment of *chronic bronchitis* and *tuberculosis of the lungs*, and is given in the dose of 10 to 30 grains (0.6–2.0) three times a day. Its advantages are its comparative tastelessness, its ready absorbability, and the fact that it does not irritate the stomach. It may be given in powder on the tongue or in capsule.

THYMOL.

Thymol, U. S. and B. P., is derived from the oil of thyme and other volatile oils, and occurs in large crystals. It is soluble in water 1 to 1500, but is freely soluble in fats and oils. Thymol is irritant in large amount. It is antiseptic and germicidal, and in saturated solution in water is the most efficient antiseptic mouth-wash. Thymol is an excellent remedy in *uncinariasis*. Under these conditions it should be used in gelatin-coated pill or konseal, and a glass of water or milk taken to avoid the burning sensation otherwise produced.

When thymol is to be given for hookworm, all fatty foods are forbidden, as this drug is soluble in fats, and when dissolved is readily absorbed, which is undesirable. The patient is starved for twelve hours, then purged with magnesium sulphate, and after this the thymol is to be swallowed. Five hours after the thymol is given, a second dose of magnesium sulphate is used to sweep out the parasites. The dose of thymol must be fairly large, from 5 grains (0.32) for a child to 60 grains (4.0) for an adult. If the patient is too feeble to be actively purged, a dose of 5 grains every week for several weeks may be resorted to. The following table of doses according to age may be followed in fairly strong persons:

Under 5 years	up to 5 grains
5 to 10 years	8 to 15 "
10 to 15 "	15 to 30 "
15 to 20 "	30 to 45 "
20 to 60 "	45 to 60 "
After 60 years	45 grains

In the treatment of *stomatitis* or *tenderness of the gums* after mercurialization, the following mouth-wash may be used:

℞—Thymolis	gr. v (0.32)
Sodii boratis	gr. xv (1.0)
Aquæ	f℥ij (60.0).—M.

S.—Place a teaspoonful (4.0) of this in ½ a tumblerful of water and use as a gargle.

Thymol has been used for dressing *wounds*, but is too costly for general use. In summer weather it cannot be employed, because of its attraction for flies, which make the patient's life miserable.

The average dose is 2 grains (0.12), in capsule or in wafer, and it is better to follow its use by a glass of milk to prevent the drug irritating the stomach. In typhoid fever as much as 30 grains (2.0) in twenty-four hours have been given as an intestinal antiseptic; in this disease it is of little value.

If very large amounts (100 grains [7.0]) are taken in a day, poisoning may result, but this much must be used before danger is present.

Thymol Iodide.

Thymolis Iodidum, U. S., is a compound of iodine and thymol, sometimes called *aristol*, but more correctly dithymol diiodide. It is obtained by the condensation of 2 molecules of thymol and the introduction of 2 atoms of iodine into the phenolic groups of the thymol; it contains 45 per cent of iodine, and was introduced into medicine for the purpose of acting as a substitute for iodoform. It should be kept in amber-colored glass vials to protect it from light. Its color varies from that of chocolate to reddish-yellow. It is insoluble in water and glycerin; slightly soluble in alcohol at 25° C. (77° F.); readily soluble in ether, chloroform, collodion, and in fixed and volatile oils, leaving a slight residue. It is free from the unpleasant odor of iodoform, and it is stated to be less apt to produce poisoning by absorption. Much contradictory experience has accumulated as to its exact value, but the result of a careful examination of clinical reports is that in some respects it is a better drug than iodoform and in others not so good.

Tichhoff and Neisser state that when taken internally thymol iodide is incapable of causing toxemia, but this can only be true when moderately large doses are given. Upon cocci and bacilli thymol iodide has less power than iodoform. In regard to the power of this drug in healing wounds or sores, the decision has been reached that whenever secretion is free it is contraindicated, as the thymol seems to increase moisture. On the other hand, in those instances where in disease of the skin or mucous membrane an undue dryness is present the effect produced is often favorable. Upon *lupus* little effect is produced unless the surface is first curetted. Finely powdered thymol iodide has been found of marked value in the treatment of *interstitial keratitis* by de Schweinitz and Wallace when dusted into the eye each day. In an ointment of $\frac{1}{2}$ to 1 dram to 1 ounce of lard (2.0–4.0 to 30.0) thymol iodide may be used in *psoriasis*, but it is not so useful as is chrysarobin in this affection.

THYROID GLAND.

Dried thyroid gland (*Thyroideum*, U. S. and B. P.) is the cleaned dried, and powdered glands of the hog, freed from fat. It appears as a yellowish amorphous powder, having a slight, peculiar odor, and containing the active ingredients of the thyroid gland; partially soluble in water. One part of the dried gland represents approximately 5 parts of the fresh gland. Occasionally it represents as much as 10 parts of the fresh gland.

Physiological Action.—The thyroid gland is a powerful factor in metabolism, and under its influence there is an increase in heat production in the body. It is an important agent in maintaining a regular basal metabolic rate when normally active. Its secretion, or hormone, is largely dependent upon its content of iodine for its activity, each gram of normal gland containing about 1 milligram.

Furthermore, the gland has an extraordinary affinity for iodine, so that iodine taken into the body is stored in great part in its substance. When iodine is lacking the gland increases in size, as if to afford a larger storehouse for any iodine that can be obtained. Conversely, if provided with iodine it decreases in size, unless the pathological process is too advanced. Thus, if a pregnant animal be deprived of its thyroid its offspring will be born with enlarged thyroids, but if such an animal be given iodine during pregnancy this condition does not arise. Minute doses of iodine are all that is needed to prevent true goiter in goitrous districts. (See Iodine.)

Therapeutics.—The thyroid gland is used for the purpose of relieving certain disturbances of nutrition of which the most characteristic are *myxedema* and *cretinism.* The results obtained from its use in these states are extraordinary, and it is to be regarded as a specific if the condition is not too well established. Its use is based upon the fact that in cases of myxedema the thyroid gland is usually found atrophied and upon the discovery of Reverdin, Kocher, Schiff, Fuhr, Horsley, Credé, Zesas, and others, that extirpation of this gland produces myxedema or a train of symptoms practically identical with it.

It is customary to employ the desiccated thyroid gland (*Thyroidum Siccum*) in a powdered form, or made into a tablet or placed in a capsule, in place of the raw gland itself. The dose of this is 1 grain (0.06) three times a day, which dose is gradually increased as the patient becomes accustomed to it. Although the remedy when first employed is given in the dose of about 1 grain (0.06), it may be rapidly increased 1 grain a day until about 6 grains (0.4) a day are reached, when a halt is made and the effect of this dose watched for some days. If the patient does not manifest symptoms of overdose, on the one hand, or if he fails to improve on the other, then the dose may be still further increased. No more than 15 grains (1.0) of the dried gland should be given each day, and this quantity should be divided into several doses.

After marked improvement or apparent cure has been effected by the treatment, it is necessary for the patient to continue using thyroid extract indefinitely, for if it is discontinued the myxedema returns. The remedy may be given in minute daily doses or in full doses for several days at the end of every three weeks or a month. Though the latter plan is the more disagreeable, it is asserted to possess a greater therapeutic and preventive value.

The rapid growth of cretins under thyroid gland therapy may lead to bending of the bones, and care should be taken that too much exercise on the feet is prevented. When used in *obesity*, an increased amount of nitrogenous food should be supplied to prevent loss of strength, as this gland causes increased catabolism not only in the fatty, but also in the proteid parts of the body. Under its influence the body cannot assimilate glucose if it is ingested in full doses, and glycosuria develops. In obese diabetics the gland is probably a dangerous drug for this reason. In the author's experience its effects are inconstant in obesity. It benefits some patients and is useless in others.

Because of the very great effect of this gland upon nutritional processes it has been employed in a host of ailments in which there has been no prospect of producing good effects. Among these, however, some experiments have resulted so favorably that the use of the gland has received recognition, although we do not understand exactly how it does good. Thus in the dose of from 5 to 20 grains (0.3-1.3) three times a day, according to the degree to which it produces its effects, it has proved of value in *acute mania* and *melancholia, puerperal* and *climacteric insanities*, and in stuporous states with *primary dementia.* The treatment should be persisted in for at least thirty days, according to Mabon and Babcock. Recently the use of full doses of thyroid gland has been strongly recommended for the prevention and relief of the early symptoms of *eclampsia* on the ground that it relaxes the renal bloodvessels, increases urinary flow, and also increases the elimination of urea.

Thyroid gland given in the dose of 5 grains (0.3) in the early morning, followed by quiet and, if possible, by sleep, sometimes relieves the *vomiting of pregnancy.* A dose may also be given at bedtime. Given during the last weeks of pregnancy it may be employed to induce a flow of milk in women who have had no secretion after previous pregnancies.

It has also been asserted that thyroid therapy is useful in the treatment of exophthalmic goiter, but this is positively untrue, and it may seriously injure such a patient, since in overdose the gland causes symptoms like those of exophthalmic goiter. In colloid goiter it may be very useful and cause a disappearance of the enlargement in a few months if given in the dose of 1 grain three times a day.

Thyroid gland, or its active principle thyroxin, has been used with success in the treatment of *Stokes-Adams disease* and is thought to depend for its good effects by increasing the metabolic rate which in turn increases circulatory activity through greater ventricular output and dilatation of the smaller vessels. The dose of thyroid gland varies from 1 to 2 grains (0.15) and of thyroxin 1 milligram once, twice or thrice a day. Such treatment should be controlled by the use of the metabolimeter and a metabolism in excess of the normal +10 should not be permitted to occur. The chief difficulty with this plan in general practice is the need of using a metabolimeter and in the fact that it is not safe if cardiac decompensation or marked myocardial degeneration is present and they often are.

Dried thyroid gland, or preparations made from it, may be substituted by *Thyroxin*, U. S., a definite chemical compound isolated by Kendall from animal thyroids, but many believe that the substance does not represent the full effect of the whole gland. It is to dried gland what an alkaloid is to a crude drug; and contains about 65 per cent of iodine, $\frac{1}{30}$ grain equaling about 30 grains of desiccated thyroid gland. Thyroxin is a stable substance. Given to an adult with *myxedema* in the dose of $\frac{1}{50}$ to $\frac{1}{40}$ grain (0.0013–0.0015) a day. This last dose taken continuously by a normal person will induce symptoms of hyperthyroidism after some days. In cretinism it is used in the dose of $\frac{1}{300}$ to $\frac{1}{150}$ grain (0.0002–0.0004). Thyroxin is to be had in powder and in tablets containing the above doses. The tablet is to be dissolved in a glass of water containing $\frac{1}{2}$ dram (2.0) of sodium bicarbonate. Its use should be stopped if the pulse-rate gets up to 100, and if the weight of the patient is decreased with great rapidity, a smaller dose should be used. It is to be recalled that its effects do not usually appear for several days, and when once established may persist for several weeks, but in colloid goiter its use often causes a rapid diminution in the size of the gland which remains small as long as the remedy is employed and it may be after it is discontinued.

Under the name *thyroprotein* has been prepared a concentrated extract assayed and adjusted so that it contains a standard amount of iodine (0.33 per cent), which is used as a substitute for thyroid extract in 2-grain (0.12) tablets made up of thyroprotein and lactose in the strength of 1, 2, and 5 per cent, each equalling $\frac{1}{50}$, $\frac{1}{25}$ and $\frac{1}{10}$ grain. It is also put in sterile ampoules for hypodermic use equal to $\frac{1}{50}$ gr. One tablet is given once to thrice a day.

In the B. P. the dried gland (*Thyroideum Siccum*) is also official, as is the *Liquor Thyroidei*, dose 5 to 15 minims (0.3–1.0).

Untoward Effects.—Overdoses of thyroid produce violent headache, feeble action of the heart, and sometimes diarrhea and vomiting. Should any of these symptoms come on, they are an indication for the complete stoppage of the use of the drug for some days, and a return to its use must be gradual. These symptoms can be avoided by cautious dosing and by keeping the patient in bed for some days after the treatment is inaugurated.

TRICHLORACETIC ACID.

Acidium Trichloraceticum, U. S., is a compound of chlorine and acetic acid, occurring in deliquescent crystals, and used as a rapid, active escharotic upon *venereal* and other *warts*. A peculiarity in its effect is that it produces a dry scab which speedily falls off, leaving a healing surface beneath. It is also claimed that its action is not followed by secondary inflammation and pain. It may be used by applying a crystal to the wart or other growth, and protecting surrounding parts with collodion, or else it is applied in liquefied form by using a glass rod and rubbing it into the part.

TRIKRESOL.

Trikresol is a combination of ortho-, meta-, and paracresol, bodies allied to creolin and phenol. Trikresol appears in commerce as a white liquid, smelling somewhat like creosote, and soluble in water in the proportion of about 2½ per cent. It forms a clear solution, and does not benumb the skin as does phenol. It is also much less irritant and less poisonous than phenol or bichloride of mercury.

Therapeutics.—Trikresol is used as an antiseptic in surgery in 1 per cent solution. In the strength of 1 to 1000 to 1 to 500 it may be employed as an antiseptic collyrium in ophthalmic practice, in which field it has proved useful.

TRIONAL.

Sulphonethylmethanum, U. S., and *Methylsulphonal*, B. P., or trional, is related, both chemically and therapeutically, to sulphonal, and is practically identical with that drug in its effects on the general system. It occurs in shining, odorless, colorless plates with a very faint, bitter taste, and is soluble in 200 parts of water. Trional is used for the relief of *insomnia* of a functional type, and the sleep produced ordinarily ensues in about twenty to thirty minutes after the drug is taken, and lasts five to six hours. The dose is 15 to 30 grains (1.0–2.0). Doses larger than 15 to 30 grains should never be given continuously, and it is always a good plan after the drug has been given for five or six consecutive days to stop its use for two or three days. It is well to order for the patient who is taking trional one of the saline purgatives daily, particularly if there is any tendency to constipation.

Trional is slightly soluble in water and very soluble in alcohol. Advantages in its use are lack of disagreeable taste and the absence of symptoms of circulatory depression. The best way to administer trional is in hot broth or tea or whisky. It is wise to decrease gradually the dose if the drug is taken night after night. Like sulphonal, trional is apt to make the patient drowsy the day after its ingestion.

When trional is taken in full dose for several weeks, it produces alterations in the blood which are manifested by hematoporphyrinuria—a state in which the urine is dark red or almost black. The drug should be stopped at once when the urine becomes red and saline purgatives must be used freely. There are no characteristic symptoms of trional-poisoning save profound coma. The pupils are not contracted as in opium poisoning.

TROPACOCAINE.

Tropacocaine is a vegetable alkaloid derived from Coca Erythroxylon as is its sister alkaloid cocaine. It is found in larger proportions in coca grown in Java than in coca grown in Peru. It is only half as toxic as cocaine. In water it forms a neutral solution, and its solutions can be sterilized by boiling. Almost its sole use in medicine is for the induction of spinal anesthesia when injected into the subarachnoid space. For such use it is best obtained in sterile glass ampoules containing about 20 minims (1.3) of 5 per cent solution, that is, about 1 grain (0.06) of the drug. This is the dose for a strong, well-developed man. For the aged and feeble 10 or 15 minims (0.05–1.0) is sufficient. The method is contraindicated in persons with a low blood-pressure. (See Procaine.)

TRYPARSAMIDE.

Tryparsamide is the sodium salt of N-phenyglycinamide p-arsenate. Although first produced in 1915 it has only recently come into favor. Its arsenic content is high (24.6 per cent) but it is relatively less toxic than the other arsenicals. It is used for the same infections as arsphenamine and seems to have an effect on general nutrition of an advantageous character over and above its parasiticidal effect. Indeed some clinicians believe that its power in affecting the parasite of syphilis is relatively feeble and that its chief value is in aiding the body to combat the infection. From these statements it is evident that it would not prove useful in early syphilis and this has proved to be the case. Its field of usefulness is in *late syphilis,* particularly *neurosyphilis* as in paresis. Tryparsamide seems to act less well in *locomotor ataxia.* It appears too that it possesses marked penetrability in all tissues and particularly is this true as to the nervous system.

The method of administration usually resorted to is to give 1.5 to 3 grams at a dose by intravenous injection once a week for eight weeks dissolving it in 10 cc. of freshly distilled sterile water and filtering through filter paper before using. If a month later the symptoms and laboratory results indicate further treatment another course is given. The best results seem to follow the intramuscular injection of salicylate of mercury in the middle of the week while the tryparsamide is being given. In many instances good results accrue only after 50 doses have been given. This drug may perhaps be considered the best of arsenicals in the treatment of neurosyphilis but some observers think it more prone to cause optic nerve trouble while others deny this. In any event it must be given with caution, if at all, if there is disease of the optic nerves or tracts and the physician should be on his guard as to this. Thus Cady and Alvis, in a report on 180 patients, met with impairment of normal vision in only 1.3 per cent, whereas in those who already had impaired vision the percentage of optic nerve injury was 37 per cent. If it is used the optic nerve should be examined weekly to see if it is being affected.

TUBERCULIN.

Tuberculin is prepared in several ways which vary widely, but the product is, to all intents and purposes, the same as to its effects, although it may vary as to its strength and applicability. It occurs in several forms as follows:

Old Tuberculin (O. T.) is made from human tubercle bacilli grown on bouillon with 5 per cent of neutralized glycerin. The bouillon is boiled until concentrated to one-tenth its volume and then 50 per cent of glycerin is added. It is then filtered to rid it of bacilli. It is chiefly used for diagnostic purposes (see below). Its diagnostic hypodermic dose is $\frac{1}{10}$ to 1 mg. Its therapeutic dose $\frac{1}{10000}$ to $\frac{1}{1000}$ mg.

Bouillon Filtrate (B. F.) Tuberculin is made as is Old Tuberculin, except that it is not concentrated and not diluted with glycerin except to the extent of 5 per cent. The only protection from living bacilli being in it is the filter, as there is no boiling. It is not used for diagnosis. Its therapeutic dose is $\frac{1}{10000}$ to $\frac{1}{1000}$ mg. It is sometimes called Denys' Tuberculin.

Tuberculin T. R. or Tuberculin Residuatum, is made by growing, evaporating to dryness in vacuo, and grinding the bacilli. The ground residue is then dissolved in salt solution and centrifuged. The centrifuged residue is again dried, ground, and dissolved repeatedly until the final addition of salt solution makes a clear fluid. Its therapeutic dose is $\frac{1}{10000}$ to $\frac{1}{5000}$ mg. This is the tuberculin most used for therapeutic purposes.

Tuberculin B. E. (Bacillen Emulsion) is prepared by pulverizing and suspending in glycerin solution tubercle bacilli. Its therapeutic dose is $\frac{1}{10000}$ to $\frac{1}{100}$ mg. for therapeutic purposes.

It is important to remember that 1 mg. of Old Tuberculin and of Bouillon Filtrate is not identical with 1 milligram of Tuberculin Residuatum or Bacillen Emulsion. The former do not contain any tubercle bacilli solids, they are only solutions in which the bacilli have grown, whereas in the case of Tuberculin Residuatum and Bacillen Emulsion the actual solids, made by grinding of the bacilli, are present in solution or suspension; that is, 1 milligram of tubercle bacilli solids weighed after drying. They are, therefore, more accurate preparations.

Physiological Action.—Although the products of the processes just described differ in their physical appearances and in their strength, the effects following the injection of any one of them into the human body is a difference in degree rather than in kind. While the filtrates have been supposed to exercise an antitoxic effect and the emulsions an antibacterial effect, there is no scientific proof of value to support this belief, and it is now well recognized that as the tubercle bacillus does not secrete or make a toxin, the word antitoxic, in the ordinary acceptation of that term, cannot be employed. On the contrary, the object of employing tuberculin, whatever its form, for curative purposes is to stimulate the protective processes of the body. To illustrate this, the following experimental result may be cited: If a guinea-pig is inoculated by the tubercle bacillus the point of inoculation speedily heals, but about two weeks later breaks down and a persistent ulcer forms. If, however, the animal has been inoculated on a previous occasion, the second spot becomes red within a few hours, soon breaks down and ulcerates, and then speedily heals. Furthermore, the nearby lymph nodes do not enlarge as after a primary inoculation. In other words, the primary inoculation has enabled the animal to overcome the second one.

It is to be remembered that tuberculin in any dose is not in itself capable of exercising an influence upon a healthy person, but only acts if an individual is rendered hypersensitive by reason of the fact that he is tuberculous. In such persons it is supposed that various antibodies or lysins are formed which split up tuberculin and so form a poison to which the cells of the body react, this change taking place not only to the tuberculin injected, but in the tuberculin formed by the bacillus which has infected the patient's body. It is to be remembered, then, that when injected in full dose into a healthy man tuberculin has no action, but when injected into a tuberculous man it has a very powerful effect, which varies with the dose and the ability of the patient to react. This effect consists in local and general manifestations. At the point of injection there is hyperemia, swelling, heat, and soreness. At the area of tuberculous infection there is a similar state. If this area is visible it is seen to be red and hyperemic. If this area is in the lung, râles often develop where before nothing but slight dulness on percussion and tubular breathing were present. The general effect consists in a train of symptoms closely resembling those of epidemic influenza. There is pain in the bones, headache, general malaise, and more or less well-marked febrile movement, often preceded or accompanied by a chill and sweat. The pulse is quickened and the patient may, if the reaction be severe, feel exceedingly ill and weak for a period varying from a few hours to even as long as two weeks or more.

Therapeutics.—When used for treatment, tuberculin is not employed as a direct curative agent, but as one which will stimulate the protective processes of the body to overcome the invading microörganism. Different methods are employed in its administration. Some give it in such large doses that the patient suffers from more or less reaction, but the best method is that in which such infinitesimal doses are given that there is no reaction in the coarse sense, but only stimulation of the protective processes. As the patient improves, larger and larger doses may be given to still more stimulate these processes, but the greatest care is to be used never to cause reaction.

Tuberculin is never to be used for treatment or diagnosis if the patient is febrile, or so feeble that he cannot react. The slightest appearance of blood in the sputum also contraindicates its use.

Acutely ill or far-advanced feeble cases are, therefore, not suitable to its use. Rapid results are not to be expected. This plan of treatment must often be used as long as a year before it may be considered as fairly tried. Manifestations that the patient is improving are a diminution of the symptoms of his disease and a gain in weight.

I am strongly of the opinion that tuberculin should be used for treatment only by those who have had special training in its use. More harm than good follows its employment by the general practitioner.

Cooke, of London, makes this comprehensive statement which I heartily endorse: "The system of dosage and the method of increase cannot be learned or acquired by reading from a text-book; and, as a matter of fact, no book could be written with any degree of accuracy on this part of the subject. It is a question of personal experience, and that can only be acquired by personal attendance at a properly conducted tuberculin dispensary several hours a week over several months."

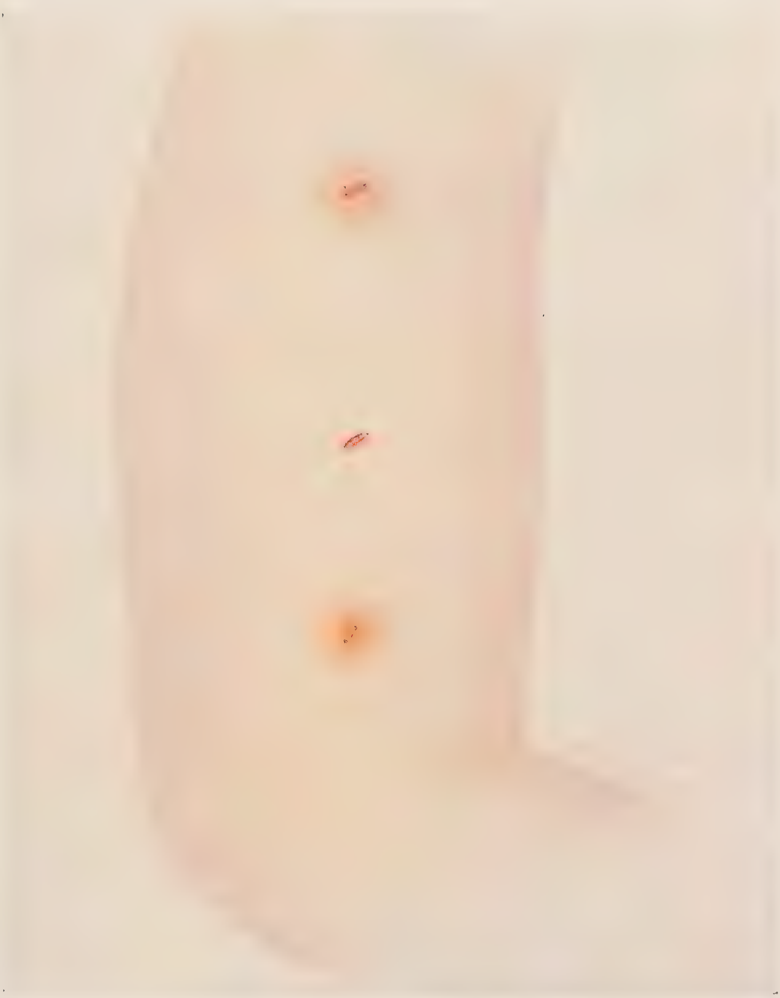
Administration.—In the treatment of tuberculosis by tuberculin it is always given hypodermically and usually into the subcutaneous tissues, not the muscles, of the back. It is best to use a specially devised tuberculin syringe graduated in hundredths of a cubic centimeter. It must be borne in mind that patients vary greatly in the dose which they can take. Each case is a law unto itself, and, in order to avoid disagreeable effects, the initial dose should be exceedingly small and in the nature of a "feeler." Further, it not infrequently happens that if no visible reaction follows the first dose, it develops after the next one, so the second dose should not be greater than the first, nor should the dose be increased until there is enough evidence to justify the belief that this can be safely done. The site of the last injection should always be carefully examined to discover if it is indurated or tender. If it is, this sign of local reaction warns against larger doses until this local irritation ceases to exist. So, too, if there is present a febrile movement, even if it be only a few fractions of a degree, the dose should be postponed. Reaction to an injection usually develops within a few hours of the injection at the latest. If fever comes on as late as forty-eight hours, it is probably due to another cause. If by an error a reaction has ensued, the treatment must stop for a period of at least ten days to two weeks after all signs of it have ceased, and, on renewing the treatment, the dose should be much smaller than the one that induced the disagreeable symptoms. The ordinary rules of strict cleanliness are to be followed as to the injection. If they are, there is no danger of local sepsis.

Dosage.—The dose varies, as already stated, according to which tuberculin is to be used for therapeutic purposes. When tuberculin is employed for treatment the initial dose is usually $\frac{1}{10000}$ mg., but if the patient is not in good condition, less than this, *i. e.*, $\frac{1}{100000}$ mg. If this small dose is well borne, the dose may be doubled, but when, by the process of doubling, the dose reaches thousandths or hundredths of a milligram, very great care must be used in making a further increase. The smaller doses may be given twice a week; the larger ones are usually employed once a week. T. R. and B. E. are now placed on the market by the best manufacturing pharmacists, in the form of hypodermic tablets, which are the best, as they are more convenient, and in small glass vials, hermetically sealed, usually containing 1 cc. of tuberculin solution, equaling 1 milligram of dry tubercle solids. If to $\frac{1}{10}$ cc. (0.1 cc.) of this solution is added 100 cc. of sterile salt solution, 1 cc. of this dilution will, of course, equal one one-thousandth of a milligram, $\frac{1}{1000}$; and if 1 cc. of this dilution is diluted by 10 cc. of salt solution, each cubic centimeter will equal one ten-thousandth of a milligram, $\frac{1}{10000}$; or, to put it differently, $\frac{1}{10}$ cc. (0.1 cc.) of the dilution made by adding 100 cc. of salt solution to one-tenth of the original package will equal $\frac{1}{10000}$ mg. The balance of the dilution so made is always thrown away unless other patients can receive simultaneous doses, as it decomposes; that is, the dilution decomposes if kept for any length of time.

Diagnosis.—When old tuberculin is used for diagnostic purposes the physician uses a dose which is large enough to cause a definite reaction *if tuberculosis is present.* In other words, he expects the injection to be followed by a rise of temperature and a certain degree of malaise and discomfort if the patient is infected by this particular bacillus. This diagnostic dose is, therefore, far larger than that employed for the purpose of increasing the patient's resistance. It usually amounts to from $\frac{1}{10}$ to 1 milligram (0.0001–0.001), according to the condition of the patient. If he is feeble, the smaller dose is the one of choice. The reaction, if the patient is tuberculous, develops in about four to twelve hours, and lasts from twenty-four hours to several days. If no reaction follows the first dose, gradually increasing doses are used, up to 5 milligrams or even more. Not only are general symptoms present, but at the site of the injection the parts are reddened and local lesions of tuberculosis show inflammatory changes. The test is not to be employed in febrile patients, that is, those whose evening temperature exceeds 99° F. It is also to be recalled that occasionally those who are not tuberculous give a positive reaction if they are old syphilitics. Tuberculous lesions long since healed, and in no way reponsible for the present ill health, may do likewise. It also fails to cause a reaction in a small proportion of tuberculous cases. The test is not, therefore, infallible.

Although those who have studied the reaction following the hypodermic use of tuberculin tell us that, when properly used, it is not dangerous, there is, nevertheless, a feeling among the majority of the profession that the reaction may be injurious to the patient. This has been the attitude of the author ever since tuberculin was first introduced as a diagnostic agent. When a patient presents sufficient physical signs or other symptoms to lead the physician to the belief that he is probably tuberculous, it is better to treat him as a tubercu-

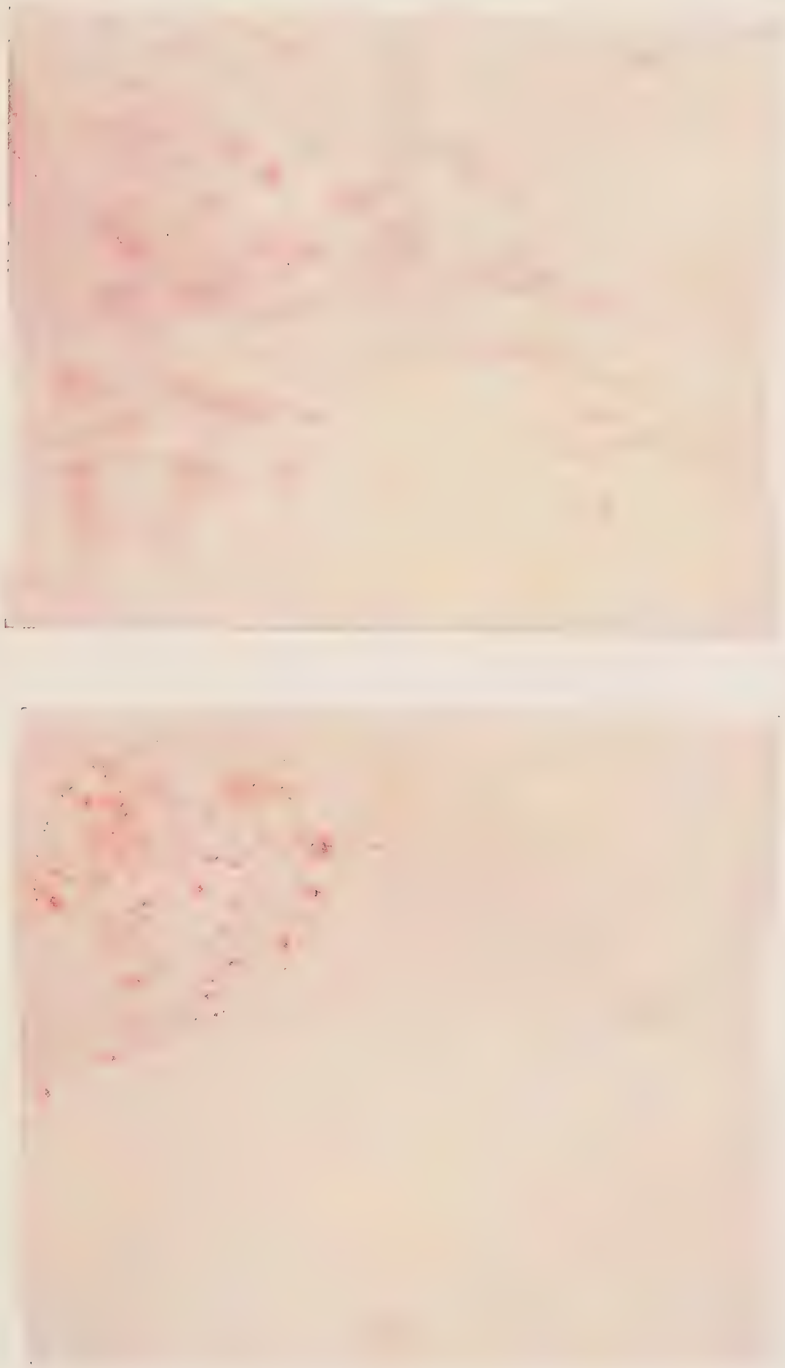
PLATE II



Positive Tuberculin Skin Reaction of von Pirquet. (Hamill.)

The middle spot, where there is no redness, shows the effect of scarification without tuberculin.

PLATE III



Tuberculin Skin Reaction of Moro. (Hamill.)

Upper figure, moderately severe reaction. Lower figure, severe reaction. In right-hand ring only lanolin was rubbed in as a control test.

lous case, since under these circumstances no harm can be done, and if not tuberculous he is certainly in a fair way to become so, the impaired lung being a ready field for the growth of the tubercle bacillus should it enter the chest. Do not forget the wise saying, "the use of tuberculin in diagnosis is like looking for a gas leak with a lighted match."

The *ophthalmo-tuberculin* test is prepared by dropping into a healthy, never into an inflamed, eye a small amount of tuberculin. This is now placed on the market in disks or tablets containing the amount necessary. This dose is dissolved in 5 drops of water, which is then dropped into the conjunctival sac. Within three to twenty-four hours a more or less sharp conjunctivitis develops, ranging from a slight inflammation to a purulent condition. If the test is negative and it is desired to repeat it, the procedure must take place in the opposite eye, because the tissues of the first eye have been sensitized and will give a reaction even if no infection by the tubercle bacillus exists elsewhere. The test fails, for some unknown reason, in a small proportion of cases which are actually tuberculous.

It should be stated as to the ophthalmo-tuberculin reaction that the majority of ophthalmic surgeons are now distinctly opposed to the general employment of this test, since there are a number of cases on record in which very violent and even disastrous changes have ensued.

The *skin test* by the use of tuberculin is in two forms, that of von Pirquet and that of Moro. In the von Pirquet test the skin of the arm, leg, or abdomen is scarified at three or four spots, as in vaccination. Into one of these spots a few drops of pure water and glycerin are gently rubbed to act as a control spot. Into the other spots is rubbed a few drops of old tuberculin solution (O. T.), which comes put up in small glass tubes like those containing glycerinated vaccine lymph. In from twelve to thirty-six hours it will be found, if the patient is tuberculous, that the spots treated with tuberculin have a reddened areola and are crusted as compared to the control spot. This test is so frequently positive in seemingly healthy adults that it loses much of its value in this class of patients. In young children it is significant. If the patient is far advanced in tuberculosis no reaction ensues.

The Moro test consists in using an ointment composed of 5 cc. of old tuberculin with 5 grams of anhydrous lanolin. This ointment should be freshly prepared or, if kept for any time, should be preserved in a refrigerator. Ten grams of ointment is sufficient for 100 tests. A small piece of the ointment about the size of a pea is rubbed into the skin of the abdomen or of the chest near the nipple. If the patient is tuberculous, a typical reaction develops in the area to which the ointment has been applied, and consists in the appearance of more or less numerous papules which are preceded by an erythematous rash. This rash develops in about twelve to twenty-four hours, but sometimes not until forty-eight hours have elapsed. It reaches its acme in most cases at the end of forty-eight hours. It possesses the great advantage of being entirely without danger to the patient, and in the avoidance of the nervous perturbation which is sometimes caused by the scratching of the skin in the von Pirquet method mentioned above. The test loses its positive value in adults, or, to express it otherwise, a number of adults who are not actively tuberculous nevertheless present the reaction.

This ointment is now placed on the market in 2-gram collapsible tubes.

TURPENTINE.

Much confusion often exists in students' minds as to the difference between oil of turpentine (*Oleum Terebinthinæ,* U. S. and B. P.) and spirit of turpentine, both of which are the same substance under a different name. This oil is not, however, the same thing as "turpentine," for the oil is distilled from turpentine. The distilled oil is a thin, clear fluid having a peculiar odor and taste, and is irritant to the skin and mucous membranes. It is exceedingly inflammable, should never be placed near a light, and if added to any strong mineral acid takes fire.

When turpentine is spoken of in this book as a therapeutic agent, the doubly distilled oil of turpentine (*Oleum Terebinthinæ Rectificatum,* U. S. and B. P.) is what is meant unless the contrary is stated.

Physiological Action.—Turpentine when taken internally produces a sense of warmth in the stomach, a quickened pulse, a warm skin, and slightly accelerated breathing. In overdose it may cause intoxication. Upon the circulation it produces a very slight rise of arterial pressure, increased pulse-rate, and increased heart-force. On the nervous system the drug, in large amounts, causes loss of sensation before it affects voluntary motion.

The drug is eliminated by the kidneys and lungs, and gives the odor of violets to the urine.

Poisonous doses causes strangury, bloody urine, renal inflammation, and cyanosis, with dilated pupils and gastro-enteritis.

In persons with an idiosyncrasy to this drug, erythematous, papular or vesicular eruptions may follow its external or internal use.

Therapeutics.—EXTERNAL USE.—Turpentine is used as a local application for the purpose of producing counterirritation over any area where deep-seated *inflammation* exists. Under these circumstances it is almost always used in the form of a *stupe,* made as follows: Place a tin cup containing the turpentine in a vessel containing hot water, so that the turpentine may be warmed without coming near a flame. Dip a piece of flannel into very hot water and wring it out in a twisted towel, and when it is so dry that no water drips from it, dip it into the hot turpentine and wring it out again to free it from any excess of the drug. The cloth, while hot, should be applied and allowed to remain until discomfort ensues, when it should be withdrawn, as it will blister the skin if left on too long. Children and adults suffering from bronchitis may be rubbed on the chest with turpentine with much relief, but it should be diluted with sweet oil, half and half, or even two-thirds of oil, particularly if the patient is a child.

INTERNAL USE.—Turpentine is used internally as a stimulant of a diffusible type in the course of the *exhausting fevers*, particularly if *flatulence* exists or if *ulceration of the bowels* is present. In *typhoid fever* turpentine stupes, turpentine enemata, and the administration of the drug by the mouth are the best ways to overcome tympanites. At the end of the second week, when the tongue is red, dry, cracked, and brown, the teeth covered with sordes, and tympany is well marked turpentine may be used in emulsion in the dose of 5 to 10 minims (0.3–0.6) three times a day with advantage. Again, in convalescence from typhoid fever, when diarrhea is persistent and due to an unhealed state of Peyer's patches, turpentine is the remedy *par excellence.*

In *intestinal* and other *passive hemorrhages,* such as *menorrhagia* of *hematuria,* the drug is often of service. It is contraindicated by acute nephritis. Why this is so is not known. It is very efficient if applied on a pledget of cotton in *bleeding after tooth extraction* and keeps the socket aseptic.

For the removal of a *tape-worm,* turpentine is given in the dose of ½ to 1 ounce (16.0–30.0), mixed with an equal amount of castor oil. This treatment is a somewhat dangerous practice, but is efficient. In chronic and well-advanced kidney disease large doses of powerful diuretics are often required to stimulate the kidneys sufficiently to increase urinary flow, and turpentine may be used under these circumstances; but it is contraindicated if any acute irritation is present, as it may under these conditions produce suppression.

Turpentine is contraindicated in the presence of any *acute inflammation of the gastro-intestinal tract* and in *acute nephritis.*

In *lumbago* the dose of 2 minims (0.12) is said to be very useful, and many have found the vapor of turpentine of value in *bronchitis* of a subacute or chronic type when inhaled from boiling water. (See Inhalations, Part III.) In *gleet* it is given by the mouth to stimulate the genito-urinary tract. Turpentine has been found of value in the treatment of *purpura hemorrhagica.*

Turpentine applied with a brush to the part affected is of service in *ringworm.*

The ointment of turpentine is used as a counterirritant and stimulant to the part to which it is applied.

A mixture of turpentine and soapsuds is efficient in destroying bedbugs.

Administration.—Turpentine may be given for the relief of flatulence by placing 5 minims (0.3) on a piece of sugar, or in emulsion (*Emulsum Olei Terebinthinæ,* U. S.) dose ½ to 2 fluidrams (2.0–8.0).

A more agreeable preparation is that recommended by Bartholow, as follows:

℞—Olei terebinthinæ	fʒj (4.0)
Olei amygdalæ expressi	f℥ss (16.0)
Tincturæ opii	fʒij (8.0)
Mucilaginis acaciæ	fʒv (20.0)
Aquæ laurocerasi	f℥ss (16.0).—M.

S.—A teaspoonful (4.0) every four hours for tympanites.

When used as an enema the following is useful:

℞—Olei terebinthinæ	f℥j (30.0)
Olei olivæ	f℥iss (45.0)
Camphoræ	gr. xx (1.3)
Mucilaginis acaciæ	f℥ss (16.0)
Aquæ	f℥x (300.0).—M.

S.—To be injected as an enema for the relief of *tympanites* and to aid in the removal of *hardened feces.* Stir thoroughly before using.

The author most commonly employs turpentine in enema by adding it to milk of asafœtida, 1 to 2 drams (4.0–8.0) to 6 ounces (180.0).

The liniment of turpentine (*Linimentum Terebinthinæ,* N. F. and B. P.) is largely used as a stimulating application to *sprains* and *enlarged joints.*

The following preparation is also official in the B. P.: *Linimentum Terebinthinæ Aceticum.*

UROTROPIN.

(See METHENAMINE.)

UVA URSI.

Uva Ursi, U. S., bearberry, is the leaves of *Arctostaphylos Uva ursi,* a widely distributed evergreen shrub. The drug is known in the B. P. as *Uvæ ursi folia.* Its active principle is arbutin, sometimes called ursin.

Therapeutics.—Uva ursi is employed in medicine as a weak, astringent diuretic, possessing alterative power over the genito-urinary apparatus. It is used in *pyelitis, cystitis,* and in *chronic gonorrhea* or *gleet.* When taken in overdose it escapes from the body as hydrochinone, making the urine dark-colored or black on exposure to the air.

Administration.—Arbutin itself is often used in the dose of 3 to 5 grains (0.2–0.3). The dose of the extract (*Extractum Uvæ Uris,* is 1 to 4 grains (0.06–0.25), of the fluidextract (*Fluidextractum Uvæ Uris,* U. S.) is 2 to 4 drams (8.0–16.0) three times a day. An infusion (*Infusum Uvæ Ursi*) is official in the B. P., dose 1 to 2 ounces (30.0–60.0).

VALERIAN.

Valerian (*Valeriana,* U. S.) is official in the B. P. as *Valerianæ Rhizoma.* Its active principle is apparently a volatile oil (*Oleum Valerianæ*). It also contains valerianic acid.

Physiological Action.—Valerian is a very feeble sedative to the nervous system, tending to produce nervous rest. In male cats it causes sexual excitement to a great degree, probably from its odor. When very large doses are given to man, it causes a sense of warmth in the stomach, a slightly quickened pulse, and sometimes nausea and vomiting. Still larger amounts produce purging and mental hebetude.

Therapeutics.—Valerian is used alone or in combination with other drugs to quiet *nervous females* and to relieve *nervousness* and *insomnia.*

Langdon Brown asserts that full doses are useful in some cases of *diabetes insipidus* associated with marked nervousness. In *hysteria* it is often very serviceable, and combined with morphine it has been much used in the treatment of *delirium tremens.* In the latter case it is probably too feeble to do much good.

Administration.—The ammoniated tincture (*Tinctura Valerianæ Ammoniata,* U. S. and B. P.), is given in the dose of 1 to 3 drams (4.0–12.0), ½ to 1 fluidram (2.0–4.0), B. P. These are the best preparations for ordinary use. The infusion, which is not official, is given in the dose of a wineglassful, while that of the simple tincture (*Tinctura Valerianæ,* U. S.) is 1 to 3 drams (4.0–12.0). The dose of the oil (*Oleum Valerianæ*) is 2 to 4 minims (0.12–0.25).

VENTRICULIN.

It has been proved by Sharp, Sturgis and Isaacs that the wall of the stomach possesses some factor, or hormone, which is fully as efficient, if not more efficient, than liver extract in the treatment of *pernicious anemia.* From the stomach of the hog is now prepared a dry granular substance, or extract, of a not disagreeable taste, which when ingested by the patient suffering from pernicious anemia, causes a rapid and effective arrest of the disease. There is a marked increase in the number of reticulocytes. During the first ten days of its administration this increase is the chief manifestation of its influence. After that time smaller doses may be given, since usually adult red cells, normal in form, tend to rapidly increase.

Ventriculin appears in vials, each of which holds 10 grams, and from 12 to 25 such vials are in a package. The beginning dose is the contents of 2 vials in the twenty-four hours. At the end of ten days or two weeks the contents of 1 vial, or 10 grams, taken once a day, is generally efficient in continuing improvement.

This dried extract is not soluble and is to be taken in suspension either in a half glass of water or in some form of fruit juice which is thoroughly stirred and at once ingested. In other instances it may be administered by mixing it with some other food, as, for example, a cereal.

VERATRINA.

Veratrina, N. F. and B. P., is an alkaloid derived from the seeds of *Asagræa officinalis,* and occurs in a grayish powder, which if it enters the nostrils produces violent sneezing which continues for hours.

Respiration.—The drug kills by failure of respiration, due to paralysis of the respiratory centers.

Therapeutics.—Veratrine is never used internally. It is employed chiefly in the form of an ointment rubbed into the skin over parts affected by *muscular rheumatism* and *rheumatic joints* and over *neuralgic nerves.* It should be used most carefully, as absorption of the drug may take place in sufficient quantity to poison the patient.

Poisoning.—The symptoms of poisoning in man are collapse, a pale, cold, wet skin, pinched features, and a rapid, thready pulse, accompanied by violent vomiting and muscular tremors. Tetanic convulsions may come on and resemble those of strychnine in that they arise from the slightest touch or draught of air; after death the muscles will be found to have lost their irritability.

VERATRUM VIRIDE.

Veratrum Viride, U. S., Indian poke, poke root, or swamp hellebore, is an American plant largely used for the purpose of depressing the circulation and nervous system. Until recently it was official in the B. P. under the name of *Veratri viridis rhizoma.*

It probably contains a number of principles, but at present our knowledge of the chemical constitution and physiological action of veratrum viride is in a state of chaos, because some of the European pharmacologists seem to confuse it with veratrum sabadilla, which contains veratrine as its active principle, whereas veratrum viride depends upon other ingredients for its effects. Confusion also exists as to the character of its active constituents. When H. C. Wood studied the drug, in 1874, he considered that viridin and veratroidine were its two chief principles. Viridin was probably an impure jervine, and veratroidine is of uncertain constitution. Salzberger has isolated an alkaloid which he calls protoveratrine which is exceedingly poisonous.

The Committee on Alkaloidal Assays of the American Pharmaceutical Association state that the constituents of veratrum are as follows: Protoveratrine, which is the most powerful and toxic; jervine, which is weak, although present in an amount about three times as great as protoveratrine; and rubijervine, which is so small in quantity and is so feeble in effect as to be almost negligible. Veratroidine, at one time thought to be an active principle, is now considered a mixture of amorphous bases.

The same contradictions exist as to its physiological properties because of the confusion in the names of its principles, and because different pharmacologists have reported diametrically opposed results. Thus, the elder Wood taught that veratrum viride is a powerful cardiovascular depressant, whereas the younger Wood reaches conclusions directly opposed to those of his father. The studies of the latter are, however, more nearly in accord with those of Houghton, and they all agree in asserting that veratrum viride greatly slows the pulse, probably by stimulation of the vagi. The primary fall of arterial pressure may be due to this slowing of the pulse, and not to any depressant effect on the heart or vasomotor system, but the dominant effect of full doses is a fall of blood-pressure due to depression of the vasomotor center. On the other hand, Pitcher and Sollman state there is no depression of the vasomotor system, but that the fall of pressure is due to the great slowing of the heart induced by stimulation of the vagus. Collins has recently shown that in man the drug decreases both systolic and diastolic blood-pressure and causes a slowing of the pulse.

Therapeutics.—Although pharmacologists are so divergent in their views as to the effects of veratrum viride, physicians of wide experience consider it of peculiar value in a number of states. Thus, many practitioners consider veratrum by far the best remedy in *puerperal eclampsia.* If given in this condition, the dose must be large, as much as 20 to 30 minims (1.3–2.0) of the fluidextract hypodermically, and followed by 5-minim doses until the pulse is reduced to the normal rate. These heroic doses are said to be absolutely necessary and not to cause any evil effects. Its use is indicated only in cases with high arterial tension, a bounding pulse, and suffused face. Under the name of Veratrone an excellent preparation of veratrum viride is used in *eclampsia* in the dose of 10 to 15 minims (0.6–1.0) by hypodermic injection. It is also of value in excessive *cardiac hypertrophy* and in the *irritable heart* of strong, healthy men. In *aneurism,* where the circulatory disturbance is great and the arterial pressure high, the drug may be used, with great care, to decrease the pressure and prevent rupture of the diseased vessel.

Contraindications.—Veratrum viride is contraindicated in all conditions of depression or exhaustion, and if vomiting is feared.

Administration.—The only preparation to employ is the tincture (*Tinctura Veratri viridis,* U. S.), dose 5 to 20 minims (0.3–1.3). The fluidextract, which is no longer official, is usually given in the dose of 1 to 3 minims (0.06–0.2). Under the name of Norwood's tincture, a saturated tincture was at one time largely sold. It is not official, and ought never be used for this reason.

Because veratrum stimulates the vagus and decreases the conductivity of His' bundle it has been used with success in cases of *auricular* *fibrillation* but as its action on the heart muscle is depressant it is contraindicated in cases in which there is advanced myocardial weakness just as is the case with quinidine.

VERONAL.

(See Barbital.)

VIENNA PASTE.

Potassa cum calce is a milder and more manageable escharotic than is caustic potash, and is used for the same purposes. (See Potassium Hydroxide.)

VITAMINES.

(See Part III, Remedial Agents Other than Drugs.)

WARBURG'S TINCTURE.

Warburg's tincture is a complex liquid formed by the mixing together of no less than thirteen ingredients. Its inventor, Dr. Warburg, held its composition as a secret for a time, but finally made it public. Since he published the original formula it has been considerably altered, and some of the preparations now sold as Warburg's tincture probably contain none of the original ingredients. Further than this, some of these ingredients are now not obtainable. It should be made as follows, if possible:

Aqueous extract of aloes	28	grains
Rhubarb	448	"
Angelica-seed	448	"
Elecampane	224	"
Saffron	224	"
Fennel	224	"
Gentian	112	"
Zedoary-root	112	"
Cubeb	112	"
Myrrh	112	"
White agaric	112	"
Camphor	112	"
Sulphate of quinine	1280	"

Dilute alcohol enough to make 8 pints.

The coarse vegetable portions of this list are to be ground into a coarse powder, and the myrrh and camphor, which have been previously pulverized, added to them. The entire mass, less the quinine, is then digested for twelve hours in a well-covered vessel on a water-bath, the alcohol being prevented from evaporating as much as possible. The liquid is now to be strained under pressure and the sulphate of quinine added and dissolved.

Therapeutics.—Warburg's tincture, next to pilocarpine, is the most powerful sweat-producer that we have, and possesses in addition remarkable antimalarial power. Its advantages rest in its favorable action where congestions accompany the malarial paroxysm.

Administration.—To be of value Warburg's tincture should be given according to the following rules: The bowels of the patient should be first opened thoroughly by a saline purge, and ½ ounce (16.0) of the tincture should be given in one dose undiluted, no other drink being taken. After the lapse of two or three hours a second ½ ounce (16.0) is given in the same way, and very shortly a profuse sweat appears, which often marks the crisis of the disease, and recovery soon takes place.

YATREN.

"Yatren 105" is iodoxyquinolin sulphonic acid plus sodium bicarbonate and is sometimes called Chiniofon. Its chief use in medicine is the treatment of *amœbic dysentery,* in which condition it seems to almost equal emetine in acute cases and quite superior to it in those subacute or chronic cases in which the amœbæ are buried in the secondary lesions. It is used by the mouth or by the rectum and it is said not to be disturbing to the gastro-intestinal tract or as depressant to the heart as is emetine. The dose by the mouth is 15 grains (1.0) three times a day. After eight days it is stopped for a week, the patient being kept at rest and then another course and period of rest until cure is effected.

When given by the rectum the bowel is first washed out with a quart of warm water containing sodium bicarbonate and sodium chloride of each 1 dram. Two hours later the injection is given. Forty-five grains (3.0) are to be dissolved in 200 to 250 cc. of warm water and injected preferably at night. The dose of yatren so given may be increased by 1 gram every second day up to 8 grams. After this it is stopped for a week and then repeated as before. Rarely it may be necessary to give even more by the rectum in severe cases. In such the dilution should be with not less than 400 cc. of hot water, but not above 110° F., because higher temperatures set free the iodine. If used over a long period it is said to disorder thyroid function because of the iodine which it contains. (See Stovarsol.)

ZINC ACETATE.

Zinci Acetas, U. S. and B. P., occurs in the form of white micaceous crystals, which are efflorescent and quite soluble in water. It acts as a decided astringent to the skin and mucous membranes, but is less astringent than the sulphate of zinc. It is used as a collyrium in *eye diseases,* such as *conjunctivitis,* in the strength of 1 to 2 grains (0.06–0.12) to the ounce (30.0). In *gonorrhea* it is often employed instead of the acetate of lead in injections of the strength of 1 to 20 grains (0.06–1.3) to 1 ounce (30.0) of rose-water.

The treatment of poisoning by acetate of zinc is that adapted to gastro-enteritis. (See Gastro-enteritis, Part IV.)

Chronic poisoning by zinc is very rare; the symptoms consist in muscular palsies, pleuritis, and cachexia.

ZINC CARBONATE.

Precipitated carbonate of zinc (*Zinci Carbonas Præcipitatus*, N. F.; *Zinci Carbonas*, B. P.) is used as a protective, rather astringent powder over surfaces affected by *weeping eczema* or other skin lesions accompanied by similar moist discharges. It may be employed to fulfil all the indications commonly treated by the oxide of zinc. It is very largely used, not as the precipitated carbonate, but as the impure or native carbonate, under the name of calamine.

The following prescription is useful for *moist eczema:*

℞—Calaminæ	ʒj (4.0).
Unguenti zinci oxidi	ʒvij (28.0).—M

Sig.—Apply to the eczematous spot.

In cases of *infantile intertrigo*, or redness of the buttocks and genitals, from maceration, due to irritating feces, in infants suffering from diarrhea, or where the urine is irritating, the following lotion is useful:

℞—Pulv. calaminxæ,		
Pulv. zinci oxidi	āā	ʒij (8.0).
Glycerini		ʒiv (16.0).
Alcoholis		f℥ij (60.0).
Aquæ	q. s. ad	Oj (480 cc.)—M.

S.—Apply with a mop after each removal of the diaper and allow to dry.

ZINC CHLORIDE.

Chloride of zinc (*Zinci Chloridum*, U. S. and B. P.) is a white, crystalline, deliquescent powder, dangerous to taste and acid reaction, possessing considerable disinfectant power. It has been used as an eye-wash in the strength of 1 to 2 grains to the ounce (0.06–0.12 : 30.0), but is rarely so employed at present. The same solution may be used as an injection in the second stage of *gonorrhea*. Small *cutaneous cancers*, particularly if near bloodvessels, may be advantageously treated by the following salve, which is efficacious and mummifies the tissues so that hemorrhage is prevented:

℞—Zinci chloridi	ʒj (4.0)
Pulv. amyli	ʒiij (12.0)
Cocainæ hydrochloridi	gr. xxx (2.0)
Aquæ destillat.	ʒij (8.0).—M.

S.—Apply as a paste.

Under the name of *Liquor Zinci Chloridi*, U. S. and B. P., is prepared a solution of the salt for disinfecting purposes of the strength of about 50 per cent.

ZINC OXIDE.

Commercial oxide of zinc (*Zinci Oxidum Venale*) is not used in medicine, but in the purified form is largely employed as *Zinci Oxidum*, U. S. and B. P., which is insoluble in water. In the form of the oxide of zinc ointment (*Unguentum Zinci Oxidi*, U. S. and B. P.) this drug affords one of the most generally used applications in the treatment of *skin diseases, burns*, and *sores*.

In all states where the surface of the skin is dry it is contraindicated, but where the eruption is moist it is useful. In the treatment of the *chloasma of pregnancy* the following prescription is of service:

℞—Zinci oxidi	gr. iij (0.2)
Hydrargyri ammoniati	gr. j (0.06)
Olei theobromæ	ʒiiss (10.0)
Olei ricini	ʒiiss (10.0)
Essenciæ rosæ	gtt. x (0.6).—M.

S.—Apply to the face night and morning.

In *eczemas* with many vesicles—

℞—Pulveris camphoræ	ʒss (2.0)
Pulveris zinci oxidi	ʒiij (12.0)
Glycerini	gtt. xl (2.6)
Adipis benzoinati	℥j (30.0).—M.

S.—Apply to the part without other treatment or precede it by powdered bismuth.

Unna's dressing (composed of gelatin 4 parts, water 10 parts, glycerin 10 parts, and zinc oxide 4 parts) is a useful application for ulcers and eczematous patches on the legs or arms. It is particularly useful for *leg ulcers*. The gelatin and cold water are put in a basin over a fire and a solution made; then the glycerin is added, and then the oxide of zinc is slowly added, with constant stirring. After the mixture is complete it is poured into a can and allowed to cool, when it is ready for use. This application decreases swelling and is soothing and supporting. It is applied as follows: The part affected is well washed with water and soap, and then with alcohol. The paint having been warmed and melted, a large 3-inch paint-brush is used to apply a coating to the limb all around the ulcer, and over this a single layer of gauze is applied. The gauze bandage should be 2 inches wide. The bandage must be laid on evenly and the ulcer covered by a pad of absorbent cotton. After one layer is applied it is cut and another coat of paint applied over it. Then another layer of gauze and another of paint are used, until several layers are in place. It is best to begin at the toes and work up toward the knee. All parts should be equally well covered. Finally the entire dressing is covered by a cotton roller bandage, which is removed in twenty-four hours, leaving what looks like a white rubber dressing on the limb. If the liquid from the ulcer oozes through the dressing profusely, a window is to be cut over the ulcer, and it can be locally treated by astringents or other measures. The patient should keep the limb elevated for a day or two, but can then walk with far more comfort than if a rubber supporting bandage is used.

In powdered form zinc oxide is useful in the treatment of *intertrigo* and for *conjunctivitis*. Mixed with bismuth subnitrate and pepsin, it is largely used by some practitioners in the treatment of the *summer diarrhea* of infants or adults.

In the *night-sweats* of debility or of *phthisis* oxide of zinc in the following formula has been highly recommended, but the prescription probably depends largely for its action on the second ingredient:

℞—Zinci oxidi . . . . gr. xxx (2.0)
Extracti belladonnæ foliorum . . . . gr. iij (0.2).—M.
Fiant pilulæ, No. x.
S.—One at night before going to bed.

The question in industrial medicine as to whether zinc oxide is capable of causing chronic poisoning seems to be answered in the negative by Drinker, Thompson, and Marsh who found that feeding quantities far in excess of ordinary intake to cats and dogs produced no symptoms or changes in the tissues even when the drug was given as long as a year.

ZINC SULPHATE.

Zinci Sulphas, U. S. and B. P., is a white, somewhat efflorescent salt, of a sharp, acid taste, and soluble in water. In large amounts it acts as an irritant, and is employed as an irritant peripheral emetic in the dose of 10 to 30 grains (0.6–2.0). It is not so severe as sulphate of copper in its emetic and poisonous properties, and may be repeated if the first dose does not produce vomiting. In weak solutions it may be used as an astringent application by injection in *gonorrhea* and other affections of the urethral mucous membrane. In 2-grain (0.12) pills it is sometimes given in *serous diarrheas*, particularly if it be combined with opium or minute doses of podophyllin $\frac{1}{60}$ grain (0.001) as a dose. In *conjunctivitis* and other eye affections the drug is used in the form of a wash. (See Conjunctivitis.)

PART III.

REMEDIAL MEASURES OTHER THAN DRUGS.—FOODS FOR THE SICK.

ACUPUNCTURE.

ACUPUNCTURE is a term applied to the deep insertion of a small pointed instrument into the tissues of any part of the body for the purpose of relieving pain, swelling, or dropsies. When used in painful affections it accomplishes its best results in lumbago. When treating *lumbago* in this manner the writer places two darning-needles in boiling water to render them aseptic, inserts them at right angles to the skin to the depth of 1 to 1½ inches so as to puncture the muscle sheath, and allows them to remain in place for several minutes. They are then slowly withdrawn, care being taken to prevent their breaking. Often after this treatment the patient can at once move more freely. Ringer, with his usual clear clinical insight, has noted that this procedure is more successful in those who have bilateral pain than in those who have unilateral pain, and the writer has found this invariably true. (See Quinine and Urea Hydrochloride in Part II, under Cinchona.)

In *sciatica* acupuncture is less successful than in lumbago, but sometimes gives relief. The needle should be inserted until it reaches the nerve, and, if possible, pierces its sheath, and it must be absolutely aseptic. Sometimes the best results follow from inserting the needle immediately below where the nerve finds exit from the pelvis. Acupuncture is useless in acute rheumatism, for the lumbar pain accompanying fevers and in sacro-lumbar strain.

Acupuncture is occasionally resorted to for the relief of *dropsy*, but it is not commonly employed. When the skin of the limbs becomes so tense with an effusion as to endanger its life, the tension should be relieved by incisions, not punctures; but saline purges are better for the removal of dropsy, if they can be used. Punctures rapidly close and cause local indurations, while incisions remain open and permit free drainage. Immediately after the incisions are made the parts are to be dressed with cotton previously saturated with boric-acid solution and dried, or with absorbent cotton sterilized by baking in an oven. It is hardly necessary to point out that the incisions must be made with antiseptic precautions. (See Antiseptics and Dropsy.)

ANTISEPTICS.

The term "antiseptic," as generally used, does not necessarily imply the power to destroy pathogenic germs. Any substance which inhibits the growth of microörganisms, which destroys or renders innocuous the poisonous products of their action upon the tissues of the body, or which retards or prevents the absorption of such products, is properly termed antiseptic.

Bichloride of mercury is efficacious as a germicide in a watery solution of 1 to 50,000. Where albumin is present the bichloride is decomposed and rendered inert. The same change is observed when solutions are allowed to stand for some length of time, even when distilled water is used as a solvent. By the addition of either sodium chloride or a weak acid such decomposition is prevented. From this it follows that under ordinary circumstances solutions of bichloride should be freshly prepared, or, if it is desirable to keep them for a long time, a sufficient amount of sodium chloride should be added to prevent precipitation of the sublimate. Koch advised that as much salt should be added as would equal the weight of the sublimate. Other observers, however, have advised ten times this weight of sodium chloride.

Since bichloride solutions, when used in wounds or in cavities of the body, are brought in contact with blood serum or other albumin-bearing tissues, care must be taken that the antiseptic powers of the mercury lotion are not destroyed by the neutralization of its active principle. The power of the solution may be preserved by using it in such excess that the chemical change has practically no effect, or by combining with it, as stated above, an acid or salt which will not in itself be unduly irritating to raw surfaces. This end is accomplished by tartaric acid. In making up a solution, 1 part of bichloride and 5 parts of tartaric acid are added to as much water as is needed. Thus, in making up a solution of 1 to 1000 for surgical purposes, the following prescription may be employed.

℞—Hydrargyri chloridi corrosivi	gr. xv (1.0)
Acidi tartarici	gr. xv vel ʒj (4.0)
Aquæ destillatæ	Oij (960 cc.).—M.

For the irrigation of large cavities solutions of a strength greater than 1 to 10,000 should rarely be employed. As tissues are devitalized by mercury bichloride, the latter should not be applied to clean raw surfaces. Solutions of 1 to 500 or 1 to 1000 are used in cleansing the surface of the body.

The method of preparing the surface of the body by bichloride for operation is as follows: The part is first thoroughly scrubbed with green soap and warm water, is shaved, and is again washed. It is then cleaned with alcohol 70 per cent, after which a scrubbing with bichloride solution of 1 to 1000 should follow. If no surgical interference is immediately indicated, the whole operative region should be enveloped in sterile gauze, and kept thus protected until the surgeon is prepared to operate. The moment the skin is incised normal saline solution should be used. The dressings, unless some peculiar form is used, may consist of sterile gauze, or of boiled, bleached, and sun-dried gauze, soaked in a 1 to 500 bichloride solution and subsequently washed and wrung out in a 1 to 4000 dilution of the same antiseptic.

Iodine has become popular for skin disinfection. Not less than a 2 per cent solution of iodine in rectified spirit is employed. An immediate preliminary washing with soap and water is undesirable, since because of the swelling of the epithelial cells from this process the iodine does not deeply penetrate. Preliminary cleansing the night before is, however, not open to this objection. The operative area is painted with the iodine solution after anesthesia is well started and again before operation. (See Picric Acid.) In patients with extremely delicate skins the iodine may be removed immediately after application by means of an alcohol compress or a 2 per cent solution of carbolic acid. The results from this disinfection are quite equal to those obtained by the more elaborate procedure described above. The iodine is simpler in its application, cheaper, and is open only to the objection that it occasionally irritates a delicate skin. This may be avoided, as a rule, by using freshly made preparations. As a direct application to dirty wounds, tincture of iodine in full strength gives excellent results. The requisite for complete cleansing is that the iodine must penetrate to every recess of the wound. Even a dirty, greasy skin can apparently be disinfected by one painting of the tincture. The addition of benzine seems to lessen its irritating qualities. (See Mercurochrome and Picric Acid, Part II.)

Formaldehyde solution is a powerful disinfectant, but when used in efficient strength is both painful and irritating. In the strength of 1 to 2000, using normal saline solution as the diluent, it may take the place of bichloride lotion for flushing large cavities or cleansing extensive granulating surfaces. The vapor has its most useful application in disinfecting rooms, barracks, dressings and instruments. (As a dry dressing, see Formidine, Part II.)

Iodoform occupies a unique place among antiseptics in having been almost universally accepted and used by surgeons and clinicians in spite of the fact that its germicidal action has been proved to be slight. It has been well said that the human body is not a test-tube, and that bacteriological research cannot supplant the evidence of clinical observation. Elaborate investigation has shown that this drug acts as a powerful antiseptic undergoing a decomposition in the juices of the body. In this way suppuration is, to a certain extent, inhibited, or if present, its disastrous effects upon the system at large are prevented, since these are due to toxine absorption rather than to a direct effect of the microörganisms themselves.

As employed in surgery, iodoform, after having been sterilized, is placed in small pill-boxes or wide-mouthed jars, over the opening of which is tied a single layer of antiseptic gauze; through this the iodoform is sprinkled as desired over wound surfaces. It is rarely used except in the treatment of chancroids and of tuberculous lesions.

Dakin's solution so-called is now official as *Liquor Sodæ Chlorinatæ Chirurgicalis.* Experience has shown that it is possessed of high antiseptic value, hence it has been extensively used for irrigation and the wet dressing of infected wounds.

Dakin's original solution failed because of its irritating properties and uncertain results.

The U. S. Pharmacopœia directs that *Liquor Sodæ Chlorinatæ Chirurgicalis* shall contain not less than 0.45 per cent and not more than 0.50 per cent of NaOCl equivalent to 0.43 to 0.48 available chlorine.

It appears as a colorless or faintly yellow liquid having a slight chlorine odor and should be kept in a dark, well-stoppered bottle in a dark place, which is cool, for not more than seven days.

There are several essential points in regard to the use of this solution if it is to produce adequate results. It must reach every part of the wound and infected spaces must be opened up so that this is accomplished. When every part is found to be sterile by cultures the wound may be closed and promptly heals. Through-and-through drainage does not do well as pockets escape irrigation. Irrigation is accomplished by multiple perforated tubes each placed in a pocket (Fig. 64).

Because of the obvious difficulties in the preparation and keeping of Dakin's solution para-toluenesulphondichloramide (*Dichloramine-T* U. S.), in other words, toluene dichloramine, or "*dichloramine-T*" has been introduced as a substitute, depending for its very high germicidal action upon the large amount of active chlorine which it contains. Dichloramine-T appears as a yellowish-white crystalline substance, when made with chloroform, possessing rather a sweet odor with some pungency resembling chlorine. When made commercially on a large scale in vacuum it appears as a powder. When first employed it was used in a strength varying from 2 to 5 per cent, the solution having been made by dissolving it in a mixture of eucalyptol and paraffine oil. The use of this mixture was resorted to first because dichloramine-T is practically insoluble in water and the use of eucalyptol causes the chlorine to be given off slowly over many hours instead of all at once. Thus, while most of the chlorine may be lost from Dakin's solution in a few minutes, the oily dichloramine-T solution lasts as many hours. The oil further acts as a protective dressing in itself and permeates all parts of the wound so that very small quantities cover a very large area. Any irritation of the skin can be avoided by using light dressings.

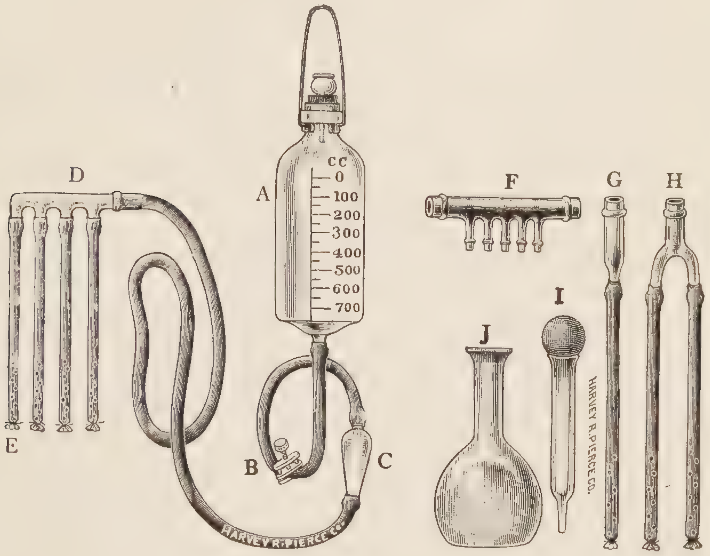


FIG. 64.—Apparatus for applying Carrel-Dakin solution. This apparatus is furnished by instrument dealers. *A*, reservoir graduated; *B*, clamp for regulating flow; *C*, sight feed cup; *D*, four-way glass distributor; *E*, perforated distributing tubes with ends tied. When used for surface ends are covered with Turkish toweling; *F*, five-way glass distributor; *G*, one tube glass distributor; *H*, two-way glass distributor; *I*, syringe for applying solution by hand; *J*, flask for use with syringe.

Even when eucalyptol is employed the product, as already stated, soon becomes of uncertain strength. Dakin has improved upon the eucalyptol-paraffine mixture by treating any pure paraffine wax that melts at 50° C. or over, with chlorine gas, at a temperature of from 120° to 140° C. until an increase in the weight of the paraffine amounts to 45 to 55 per cent. Hydrochloric acid develops which is removed by shaking with about 5 per cent of dry sodium carbonate and the hot oil is then filtered through dry fluted paper. It is now ready as a solvent of the dichloramine-T and is called "*Chlorcosane*" because the predominating hydrocarbons of solid paraffine are designated by terms ending in "*cosane,*" the prefix "chlor" indicating the presence of chlorine. When making the solution of dichloramine-T in chlorcosane it is best to warm one-fourth of the latter to 80° C., then add the dichloramine-T, usually not in excess of 5 per cent; and stir until it is dissolved, when the remainder of the chlorcosane at room temperature is added and filtered. When decomposition of the dichloramine-T in chlorcosane has occurred it shows an abundant deposit and the oil should be discarded. If soon after it is made it is found to be cloudy or precipitated from exposure to cold it may be gently warmed when, if not decomposed, it becomes clear. Dichloramine-T in chlorcosane should be neutral in reaction because even a faint trace of acid rapidly decomposes it. Acidity can be determined by wetting a piece of blotting paper with ammonium water and holding it over the preparation. If acid is present opaque white fumes of ammonium chloride will be given off from the paper.

Dichloramine-T is without doubt one of the best wound dressings that we have, both as to cost and efficiency, particularly where large numbers of wounded are to be treated and if it is so frequently made that there is always a supply of the fresh preparation on hand. As, however, it soon deteriorates when kept it does not lend itself as an antiseptic dressing to the private practitioner who only has an opportunity to employ it at long intervals. Sunlight, water and alcohol decompose chloramine, which must be kept in a dark amber glass bottle. Blue glass containers are not efficient because the rays of light which pass through it decompose the compound. So essential is it that no water shall come in contact that a glass pipette which has been sterilized by boiling and is still wet must not be introduced into the solution, because the minute amount of water adhering to the pipette will result in decomposition. (See Chloramine-T.) A dry pipette is the best way to apply it. A very minute amount of the oily solution is required and it is a mistake to use it too freely. Dichloramine-T will fail as an antiseptic dressing if dirt, foreign bodies and pieces of bone are left in the wound. Use only a light dressing.

Superficial wounds of large extent and burns may be treated by dichloramine-T according to the plan of Lee and Furness. They spray the area with a 1 to 2 per cent solution in chlorcosane. Over this they place strips of paraffinized mosquito netting made in the following manner. Ordinary $\frac{1}{16}$-inch netting is not washed to get rid of the sizing but sterilized by heat as are ordinary dressings. Pick up the strips of netting with forceps and dip in thoroughly melted paraffine wax which melts at about 50° C. Then lift them out of the wax and hold them, or hang them, over the heat so that the excess of melted wax runs off leaving the interstices open. Then cool and keep for use by wrapping in sterile towels. The method permits free drainage of secretion which the ordinary paraffine method (see Burns, Part IV) of treating burns lacks and obtains the primary antiseptic properties of the dichloramine-T.

Chloramina, U. S., or sodium paratoluenesulphonchloramide, occurs as a white, crystalline solid with slight odor, containing 2 per cent of chlorine. It is soluble in water and in solution is quite stable even when exposed to light. It is because of its stability not so powerful a germicidal effect but is efficient. A 2 per cent solution equals in value a 0.5 per cent of Dakin's solution. This 2 per cent solution may be kept in stock and diluted if desired with normal saline before using. Under the trade name *Chlorazene* chloramina appears in tablets of 4.6 grains by means of which a solution may be readily prepared.

Among the newer antiseptics should be named acriflavine and neutral acroflavine. Acriflavine (see Part II) occurs as a brownish-red, odorless crystalline powder, soluble in less than 2 parts of water and forming a dark fluid. It is a moderately successful antiseptic used in a 1 to 1000 solution of normal saline for washing wounds and infected cavities. In the latter case some of the fluid should be left *in situ* if possible. When large cavities are to irrigated a 1 to 4000 solution is employed. Stains of the skin can be removed by washing the part in dilute hydrochloric acid solution and then with plain water. (See also Metaphen, Hexylresorcinol S. T. 37, Dibromin and Neutral Acriflavine, Part II.)

Peroxide of hydrogen is applicable, not to sterile surfaces, but to suppurating wounds and sinuses. It is used in the strength of from 50 per cent up to full concentration. When this drug is poured into a suppurating sinus or cavity an ebullition takes place, which ceases only when the drug is exhausted or the dead material has been oxidized. It should never be used in a cavity from which the gas cannot readily escape.

For the sterilization of mucous surfaces a saturated aqueous solution of *boric acid* is commonly employed. More potent than this are the silver salts. (See Silvol, Neosilvol in Part II.)

An omission of the details of cleansing the hands of the surgeon and assistants in preparing for an antiseptic operation is scarcely permissible when writing upon the subject of antisepsis. The most approved method is as follows:

The hands and forearms are thoroughly scrubbed in sterile water, using preferably green soap, cleansing the nails with an orange stick in the beginning of the scrubbing and during it. When practicable this cleansing should be done under a stream of running sterile water; when this is not possible the water in the basin should be changed three times with fresh sterile water. This scrubbing with soap and a brush should be continued for at least five minutes. Thereafter the hands are washed in alcohol (60 per cent) for one minute and are then soaked in a solution of bichloride of mercury 1 to 1000 or biniodide of mercury 1 to 1000 for one minute, then dried by a sterile piece of gauze, and sterile rubber gloves are put on. For the use of hydrogen peroxide and soap for this purpose, see Hydrogen Peroxide in Part II.

A more rapid method of effecting disinfection, and one which, from a laboratory standpoint, has proved to be entirely efficacious, is by means of a mixture of chlorinated lime and boric acid in equal parts; 1 teaspoonful of this is added to 1 quart of water, and after preliminary cleansing with soap and water, the hands are immersed in this solution for fifteen seconds.

Any method which irritates or cracks the skin of the hand is dangerous. The only certain way of avoiding infection from the hands of the operator lies in the use of sterile rubber gloves.

ANTITOXIN.

The method by which protection is obtained by the use of antitoxic serum is best explained by the hypothesis of Ehrlich, which has withstood the test of scientific investigation very well and is now generally admitted to be the true explanation of this interesting subject. It is assumed that all cells have the power of combining with the food products that are needed by them for sustenance by means of receptors or parts which have an affinity for each form of food required. A cell may have many of these receptors, each of which is suited to the appropriation of a definite kind of foodstuff, and is unable to appropriate or become attached to any other variety of food. As soon as a receptor has been utilized for the appropriation or attaching of a particle of food, the cell immediately makes another receptor, and, in many instances, makes a far greater number of these receptors than is necessary, particularly if the demand is very great. These extra receptors are, when made in excess, thrown off into the blood, where they exist unattached to the cells which originated them.

The poisons or toxins of disease are known to be complex proteid bodies closely resembling food bodies, and therefore these poisonous products of bacteria unite with the receptors of a cell, and instead of nourishing it, produce its death. An animal or a man may be naturally immune to a disease by reason of the fact that the cells in his body may be devoid of receptors capable of combining with a given poison, or by reason of the fact, which is the case in acquired immunity, that his cells have thrown off so many extra receptors into the blood that the toxins unite with them, and as they are unattached to cells the animal is not affected. These receptors are also called antibodies, and when serum of a horse is injected into the tissues of a child suffering from diphtheria, this serum contains so many antibodies or receptors that the toxins of the disease are locked in the embrace of the antibodies in such large numbers that the cells of the body itself are not overwhelmed by the infection. In the case of diseases such as scarlet fever and smallpox, which rarely attack the same person twice, it perhaps may be said that immunity is conferred by the tissues being trained or educated, as it were, to prepare antibodies in such large amounts when called upon that the entering wedge of a new attack is snapped off at the moment it begins to enter the field.

That an actual combination takes place seems to be proved by the experiments of Martin and Cheny, who found that the toxin of diphtheria will pass through a Berkefeld filter covered with gelatine, whereas the antitoxin will not do so because its molecule is too large. If the toxin and antitoxin are mixed, the toxin ceases to pass through the prepared filter because, having united with the receptor, its molecule is too large.

When an animal, usually a horse, naturally able to resist infection to the extent of complete immunity is found, it is desirable to still further increase the immunity of its blood serum or to stimulate, if we may use such a term, his antitoxin-preparing powers. With this object in view injections of the toxin derived from cultures of pathogenic germs are made into the blood of the naturally immune brute. As result, the serum of the blood of the animal after a time possesses an increased power of resisting infection, and also confers immunity of a temporary kind upon any other animal into whose body some of it is injected.

In individuals who are naturally sensitive to horse serum or who have been artificially sensitized by previous doses severe symptoms may develop. Repeated doses do not immediately sensitize, but a dose of antitoxin given after the lapse of ten days following a previous dose may rarely develop anaphylaxis.

In such patients the injection of antitoxin serum is followed by the development, within a few hours or even after several days, of urticarial or erythematous rashes and swelling and pain about the joints. The joint symptoms may not appear for ten days. These symptoms are more prone to develop when high-potency serums are employed. A number of cases are on record in which death has ensued, the alarming symptoms consisting of sudden flushing and cyanosis of the face, severe dyspnea, and rapidly developing unconsciousness with signs of pulmonary edema. Death has taken place within five minutes of the injection. It is difficult or impossible to determine before hand what cases will, because of idiosyncrasy, suffer in this manner, save that asthmatics, those who suffer from hay fever, and patients of a marked lymphatic type seem more prone to it than others. Any one may be sensitized to foreign serum by having had serum of any kind on a previous occasion and this sensitization may persist for years or always remain. Always before the use of serum a careful history of the patient should be taken to discover if this condition has been induced.

To these severe symptoms the term anaphylaxis is applied.

Sensitiveness to serum can be determined to a great extent by the following measures:

Wash the skin of each forearm with alcohol, then inject not more than 0.05 of a 1 to 10 dilution of the serum in normal salt solution intradermally (not hypodermically) into one forearm. Into the other forearm inject intradermally a few minims of normal salt solution or normal human serum. After from ten to thirty minutes, if the patient is sensitized, it will be found that the wheal produced by the injection of the serum has increased in size and is erythematous around its edges, whereas the control test in the opposite arm shows no such reaction. Such a reaction indicates sensitization and its severity, in a general way, may be said to indicate the degree of sensitization. In some instances, however, the mere intradermal injection of human serum, or of salt solution in the control arm, produces so much reaction that it is difficult to determine the exact value of this test and this is particularly true if the serum has not been diluted as directed above.

In other cases the test can be made by dropping 1 drop of the serum 1 to 10 into the eye of the patient. If sensitized, a moderately sharp reaction will take place in the conjunctiva. If it should be severe, a few drops of adrenalin solution should immediately be placed in the conjunctival sac for relief.

If there is urgent need for the use of serum, the following measures may be taken for desensitization, although they are not absolutely reliable: Minute doses of the serum, not more than 0.01 cc. may be given hypodermically and if no disagreeable symptoms occur, the dose can then be doubled every half hour until 1 cc. is given. If this fails to produce a reaction, the patient may be considered as desensitized. (Besredka's method modified.) If a patient is very sensitive, intravenous or intraspinal injections are not to be practised.

Should the doses just named produce symptoms of anaphylaxis, adrenalin should immediately be given intramuscularly and the part rubbed to hurry absorption, and, if the symptoms are very severe, 5 or 10 minims of the 1 to 1000 solution should be given intravenously.

So far no method has been devised by which the desperate symptoms of severe anaphylaxis can be cured. Adrenalin has been used with considerable success. The drug which would seem to promise the most relief, so far as the pulmonary edema is concerned, is atropine in full doses. Ether by inhalation has also been praised.

Notwithstanding the startling effects in these cases, it is to be distinctly understood and sharply emphasized that the number of these accidents has been so infinitesimal as compared to the hundreds of thousands of injections given that no hesitation should be tolerated in the use of antitoxin in diphtheria and tetanus, for the danger of the disease is great and that of the injection is so small as to be negligible. Thus, in 100,000 cases of diphtheria, reported by Park, in which immunizing doses were given, only 1 death occurred and that was a child who had status lymphaticus.

An important fact to be borne in mind is that the injection of horse serum at any previous time in the patient's life may have produced sensitization, thereby producing a state in which the severe symptoms already spoken of may ensue when a subsequent dose is given. This does not take place in those receiving serum the first time if the doses of serum are given every few hours or even every other day for an indefinite period of time during the course of the disease. It is only when a longer interval elapses between doses, amounting to seven days or more that the patient is in danger of anaphylaxis when an injection is given. In other words, a patient who has received an immunizing dose of antitoxin, or a curative dose, is far more likely to develop evil symptoms after a dose given some time later than a patient who receives the antitoxin for the first time in his life.

The lesson to be learned from this in practical medicine is that when a patient gives a history that any antitoxin has been previously used, the physician should be cautious in the administration of the remedy, but when a second attack of diphtheria is actually present the danger to life is certainly far greater from the disease than from the possible development of anaphylaxis.

In a large proportion of patients after a period of eight to fourteen days so-called "serum sickness" develops consisting in pain in the joints, a rose rash or urticaria. Here again a small dose of adrenalin is useful for temporary relief and acetylsalicylic acid may be given for the pain.

Besredka has shown that the danger of anaphylaxis is decreased if very small doses (0.5) of the serum are given every half hour for two or three hours before the full dose is used.

Antianthrax Serum.

It has been conclusively shown that the use of this serum should entirely supplant surgical or other measures in the treatment of this disease. Those with the greatest experience (Regan, Eichhorn, *et al.*) advise in mild cases, with a small lesion, 50 cc. of serum not oftener than every twelve or twenty-four hours. The first injection should be intravenous, the subsequent ones intramuscular or subcutaneous. In more severe cases, with marked constitutional symptoms, 50 to 100 cc. are to be given intravenously every eight to twelve hours for 3 or 4 doses, then intramuscularly. In severe cases 100 to 200 cc. every six to eight hours for 6 or more doses when, if the disease is controlled, the dose is halved and given every twenty-four hours. In the very septic cases 200 to 300 cc. are used every three to six hours, until signs of septicemia disappear. The fluid injected should be warm and given very slowly. Locally from 10 to 12 cc. are injected into the lesion itself at its indurated border and into the tissues underlying the pustule. This may cause a primary local reaction which may be ignored. By the introduction of this antitoxin an infection hitherto followed by great mortality can now be controlled, if recognized early enough.

Antidiphtheritic Serum.

Antitoxinum Diphthericum, U. S.—The following process is followed in its preparation: a pure culture of the bacillus of this disease having been grown, colonies of the bacillus are picked up off the culture gelatin and placed in tubes of blood serum, which in turn are placed in an incubator. After a time flasks of bouillon are inoculated by the germs. These flasks are then placed in an incubator, where there is rapidly produced the diphtheritic poison in the bouillon. After a length of time sufficient for the development of the poison the fluid has added to it a small amount of some preservative, and is then filtered through unglazed porcelain, whereby all the bacilli and other particles are separated, the filtrate being a clear, straw-colored fluid. This is the fluid containing the toxin. The toxin of each flask varies in its power, so it is necessary to determine its activity. This is done by injecting it into guinea-pigs, which animals are very susceptible. Usually from 2 to 100 milligrams are required to cause death within a few days. A young, healthy horse now receives about 1 cc. of the toxin by subcutaneous injection; that is ten times the fatal dose for the guinea-pig, provided the fatal dose was 0.1. Horses are chosen because they are naturally immune, have large amounts of blood serum, and are easily handled. Gradually increasing doses are given until the horse can readily receive several hundred times the first dose without any ill-effects. The horse is now capable of rendering antitoxic serum, and he is bled. The blood serum is separated and purified and is then tested to determine its power. The tests applied are such that the strength of serum is measured by units of antidiphtheritic serum.

An antitoxin unit is the unit established by the Hygiene Laboratory of the U. S. Public Health Service. It is required that the container holding the antitoxin shall bear a label stating the time which may elapse before the potency stated on the label may be considered to have decreased. This date must be not longer than one year after it is produced if the manufacturer has placed 20 per cent over the minimum in the container; two years if he has introduced a 30 per cent increase, three years if he has added 40 per cent and four years if he has added a 50 per cent excess. Should the physician be unable to obtain any antitoxin except that bearing an older date he should nevertheless employ it for what it is worth, provided the container is intact and the fluid evidently normal in appearance, on the principle that half a loaf is better than no bread. (See Diphtheria and Toxin-antitoxin under Diphtheria, Part IV.)

Antidysenteric Serum.

This serum is used only in *bacillary dysentery* and is of no value in amœbic dysentery. The horse is employed to produce the serum and, as a rule, one animal is given cultures of the bacillus of Shiga and another horse those of the bacillus of Flexner. The antiserum made by the Shiga bacillus has little if any value if used against infection by bacillus of Flexner and *vice versa.* Therefore, if it is possible to determine, by laboratory technique, that either the bacillus of Shiga or that of Flexner is the cause of the illness the specific antiserum is to be employed, but as this is usually out of the question it is customary to mix, or pool, the antiserum derived from each horse, thereby making a polyvalent serum. Both sera not only neutralize the toxins produced but act as a protection against infection.

Antidysenteric serum is usually given hypodermically in the dose of 20 cc. for an adult or half of this for a child, but if the infection is severe the dose may be much larger and may be given intravenously in doses as large as 50 to 100 cc. to an adult. Response is usually very prompt, the nervous symptoms improving in a few hours and the diarrhea and tenesmus decreasing in twenty-four hours. Sometimes complete recovery occurs in less than a week if the case is treated early in the malady. If the serum is used after the disease has been present for several weeks so that the state is one of chronic bacillary dysentery, little if any good from the use of this serum ensues. Flexner states that in mild epidemics with a mortality of 10 to 15 per cent the serum reduces it to 1 or 2 per cent and in some outbreaks with a mortality of 50 per cent this treatment may result in the death-rate being only 10 per cent. Graham of the British Army advises that in toxic cases a 5 per cent solution of levulose should be given intravenously. (See Intravenous Medication and article on Diabetes.)

When used as a prophylactic the dose is usually 5 cc. but the protection endures for only about two weeks.

Antierysipelatous Serum.

This serum is obtained by the inoculation of the horse with the streptococcus erysipelatus. Erysipelas in many instances is a mild malady in that it does not have a fatal ending. Much depends upon the state of the patient's resistance. In infants, who have little resistance, it is wise to use this serum and also when erysipelas occurs as a complication of diabetes or carbuncle.

This serum has no prophylactic value, that is, it does not protect against subsequent attacks nor does it seem to protect against complications save that by shortening the illness and modifying its course secondary lesions are avoided.

Statistics show that it definitely shortens the illness particularly in facial cases. Antierysipelatous serum is to be given intramuscularly, not hypodermically. The first dose is usually 10 to 20 cc. within twenty-four hours, repeating the 10 cc. dose every twelve hours until a notable change for the better takes place. As a rule a total dosage of 40 to 60 cc. are needed.

The potency of this serum is sometimes measured in units, 1 unit being the amount needed to neutralize 100 skin-test doses. When such a standardized serum is used the dose for an adult is about 3000 to 5000 units every day, but if after 30,000 units has been employed the patient does not improve it should be stopped as it fails to do good even if continued. It has nothing like the effectiveness of antidiphtheritic serum for diphtheria.

Antigonococcic Serum.

Antigonococcic serum, prepared from the blood of horses, is now recognized as a valuable remedy in the treatment of *gonorrheal rheumatism.* It has not, for unknown reasons, proved of material value in the treatment of gonorrheal urethritis or epididymitis. The method of using it consists in injecting 2 to 12 cc. of the serum intramuscularly, or hypodermically, at intervals varying from two to six days. The best site for the injection is the abdominal wall. It causes both a local and a general reaction in a few cases. The local reaction consists in dermatitis or urticaria and enlargement of the inguinal glands. The general reaction consists of a rise of temperature of from 1 to 2 degrees and a quickening of the pulse. All these symptoms disappear in about twenty-four to forty-eight hours. Doses of this serum given at long intervals sometimes cause anaphylaxis, as does any foreign protein substance. (See Diphtheria.)

Antimeasles Serum.

(SEE ARTICLE ON MEASLES, PART IV.)

Antimeningitis Serum.

Flexner has produced an antimeningitis serum from horses, inoculated with the Diplococcus intracellularis and its products, which has proved itself capable of reducing the mortality of epidemic cerebrospinal meningitis about 60 per cent if it is used early enough to protect the patient from well-developed lesions. This serum should be made from the two main types of meningococcus with some of its subsidiary strains. The properly made serum not only saves life, but greatly decreases the frequency with which those patients who recover from the attack suffer from sequelæ, such as deafness, blindness and deformities. It causes the turbid cerebrospinal fluid to become clear, and facilitates phagocytosis and arrests the growth of the specific microörganism as well. Its effects are bactericidal or phagocytic rather than truly antitoxic. The dose should be repeated daily to prevent relapses and to produce a cure. Antimeningococcic serum is not given hypodermically but intravenously and by intraspinal injection. (See Lumbar Puncture and Procaine.)

It is given intravenously, in the dose of about 100 cc., to combat the bacteriemia of the disease, but as a meningococcemia is not always present, and intravenous injections of this serum sometimes causes severe reaction (see Besredka's Method under Antitoxin), it is best to withhold this method unless the coccus is found in the blood. Before it is injected intraspinally an amount of cerebrospinal fluid equal to the amount of serum to be injected should be allowed to flow out of the needle. Although the fluid withdrawn should be examined microscopically and cytologically, to make the diagnosis certain, the serum should be immediately injected if the spinal fluid is cloudy, as delay may be fatal, and even if the symptoms be due to the pneumococcus or the tubercle bacillus no harm will be done. While the puncture is being made and the fluid withdrawn the blood-pressure should be taken. If the fall of blood-pressure equals 5 to 10 mm. the withdrawal should cease. So, too, when the serum is being introduced, if the pressure falls care should be exercised to be more gentle, and if the pressure falls as much as 15 or 20 mm. the injection had better be stopped.

Marked blood-pressure variations can usually be avoided if the fluid is not allowed to escape too fast and the injection is not made too rapidly. It should be introduced by the gravity method, not by the syringe, with great slowness. The dose of the serum is measured not by units, but by cubic centimeters. The first dose of antimeningitic serum varies from 5 to 20 cc. for a child to 20 to 50 cc. for an adult. Infants under one year of age should rarely be given more than 10 cc. The maximum doses for other ages may be considered as follows: One to five years, 15 cc.; five to ten years, 20 cc.; ten to fifteen years, 25 cc.; fifteen to twenty years, 30 cc; adults, 50 cc. The injection is usually made once a day unless the symptoms are severe, when it may be repeated every twelve hours. It is wise to leave the needle in place for some minutes after the injection is made to see if symptoms of too great intraspinal pressure develop, in which case some fluid should be withdrawn. This is best tested by the use of a manometer. The normal pressure as taken by a water manometer is from 60 to 120 millimeters varying with the posture of the patient, it being higher if he is sitting up. The normal with a mercury manometer is about 8 to 10 and 15 is abnormal.

The repeated injection of antimeningococcic serum may induce an aseptic meningeal irritation (meningismus) with fever and rigidity of the neck. If this is the case the injections should be stopped. If these symptoms are due to a relapse of the disease serum should be continued. The question is settled by examining the spinal fluid which in meningismus contains its normal glucose and does not show meningococci. If glucose is absent serum should be used. Turbidity is of little value as an aid in diagnosis under these conditions.

Antiperfringens Serum.

Antitoxin for relief from infection by the *Bacillus perfringens* sometimes called the *Bacillus welchii,* is used with antitetanic serum because this bacillus is often found associated with the tetanus bacillus. (See Antitetanic Serum.) It is also used in certain cases of peritonitis and intestinal obstruction because the toxemia of these conditions is often due to the absorption of the perfringens toxin through the bowel wall. It has, in certain series of cases, reduced the mortality from 70 per cent to 20 per cent.

Antipneumococcus Serum.

As pointed out in the article on Pneumonia (Part IV) of the so-called croupous type, this disease may arise from many different strains of the pneumococcus. Further, it is to be recalled that many patients suffering from this disease are not only infected by any one of the four types I, II, III and IV, but with other pathogenic organisms which possess lethal power, notably various strains of streptococci and that one (or those) which produce an attack of influenza. No serum or antibody solution has as yet been produced which possesses the curative properties characteristic of the serum used in diphtheria, one reason being, perhaps, that, as just stated, the infection is a multiple one in many instances.

The frequency with which infection with any one of the four types already mentioned occurs is relatively as follows: Type I about 25 per cent, Type II about 21 per cent, Type III about 14 per cent and Type IV about 40 per cent. This percentage varies greatly in different seasons and years and in different localities and relatively near areas may vary widely as to the types during the same season of the same year. Indeed it would appear that while nearly all cases in one city may be due to one of the types named, in another city the dominant organism is a streptococcus. It is also interesting to note that the mortality of the different types varies greatly. That of Type

I being about 30 per cent, Type II about 50 per cent, Type III about 55 per cent, and the mixed strain Type IV about 30 per cent. It is evident that these facts militate greatly against the use of any one antipneumococcic serum even if it be possible to determine the type which is seemingly the cause of the illness, and if it be possible to decide that other microörganisms are not largely responsible for the illness. For these reasons polyvalent serums are employed, yet it must be manifest that if the proportion of serum present is best fitted to combat Type I, for example, the other proportions are too small. Further in many cases the patient has already been ill many hours or days before coming under observation, so that the infection has already greatly damaged the lungs, the heart and other organs so that giving antipneumococcic serum can produce no better results than diphtheria antitoxin if given as late as the third or fourth day in that disease. Again, the collecting of the sputum or of the blood of the patient for the determination of the type present consumes time and in many instances, unless the patient is in a well-equipped hospital, it is not possible to find out which type is present.

The finding of the pneumococcus in the blood stream is of very grave import. If it is proved by the laboratory that a pneumococcemia is present, then an antibody serum probably should be given.

When every facility is at hand statistics seem to prove that the protective products now used if given early, do reduce mortality, varying with the type. Thus Cecil, whose mortality rates are higher than those given above, gives the following comparative table to show the effects of so-called Felton's serum:

Type	Serum given	Controls no serum
I	22.7 per cent	34.6 per cent
II	42.5 per cent	60.0 per cent
III	33.3 per cent	28.1 per cent
IV	23.7 per cent	35.9 per cent

Up to this writing Felton's serum seems to be the best in its results but a serum that permits a mortality of more than 42.5 per cent in Type II evidently lacks the power needed. Although these figures seem to show that Felton's serum does good in Types III and IV, it is noteworthy that Cecil states that it should not be given in Types III and IV as it is useless.

All the serums used in pneumonia should be given intravenously, very slowly over several minutes. Reactions to Felton's serum are either characterized by a moderate chill or represent allergy that is serum sickness. The chill needs no therapy, the allergy can be corrected by 5 to 10 minims of adrenalin 1 to 1000 given by needle. In asthmatics, or in those who have become sensitized by previous treatment with horse serum, this treatment had better be avoided. Sensitiveness can be determined by the reaction to an intradermal test or by dropping a single drop of normal horse serum diluted 1 to 10 into the eye when a sharp reaction will develop in fifteen minutes if sensitized. This can be overcome by a few drops of 1 to 1000 adrenalin. So, too, if cardiac decompensation is present serum is not devoid of danger.

Felton's antipneumococcic serum is given by units, a single unit being the amount of serum needed to protect a mouse against 1,000,000 minimal fatal doses of culture. Each syringe of 20 cc. contains 10,000 units for Type I and 10,000 for Type II, that is 20,000 units. The dose of the serum for an adult patient is usually 10 to 20 cc. against Type I and 20 cc. for Type II. The dose is given by vein about every three to six hours for 3 doses, but if the blood culture is positive it is repeated until crisis is reached.

The use of the word serum in connection with the preparation made by the method of Felton is not exactly descriptive of the product. As ordinary pneumococcic serum has to be given in very large doses the protein reaction is usually very severe. Felton precipitates such serum with water and thereby obtains the globulins containing the desirable antibodies. Before giving it intravenously it should be warmed but not about 100° F.

There is, up to date, no antibody for Type III and IV. When good results are obtained in these types, or indeed in any type, protein therapy may be a factor for good. It is noteworthy that even some of those who are most optimistic as to serum treatment of this disease nevertheless admit it is not an adequate treatment in itself and cannot be relied upon as a substitute for all other treatment. (See article on Pneumonia Part IV.)

It is particularly important to use full doses in Type II infections.

Antipoliomyelitis Serum.

Antipoliomyelitis serum derived from human beings who have suffered from the disease, or from horses which have been immunized, has proved of great value if used early in the attack and ought always to be given with the hope that it may prevent sequelæ. When human serum is resorted to the best seems to come from those who have recovered from an attack of the disease within a space of time varying from several weeks to two years, but serum has been used when as great a time has elapsed as thirty years. If a donor can be found he must be free from other disease. About 500 cc. of blood may be taken from an adult or 250 cc. from a well-developed child. After the serum is separated from the clot it is activated at 55° C., tested to prove that it is sterile, and preserved by the addition of tricresol 0.2 per cent. It is then kept in an ice-box. The earlier it is used in the attack the better. For this reason an early diagnosis is essential.

The following points are to be considered as indicating the preparalytic stage: a moderate fever averaging about 102° F., severe headache which may seem to be chiefly in the nape of the neck, or there may be pain of a severe character in the back, rigidity of the neck as to anterior flexion is present, but there is a notable absence of lateral limitation of movement. Fine trembling of the lips and hands is often present. This tremor in the hands is an intentional tremor. There may be vomiting once or twice a day, constipation, retention of urine, some mental apathy, and sweating about the lips and neck. It is noteworthy that the mental apathy can sometimes be at once dissipated if the patient is aroused when he becomes irritable.

Spinal puncture reveals a notable increase in lymphocytes in the fluid, or if seen very early the polymorphonuclear cells may exceed the others. It is noteworthy that after paralysis develops the excessive cell content disappears, but globulin remains in excess.

This serum is to be given intraspinally in a dose of 10 cc. to a small child or 25 cc. to an adult, after being warmed to body temperature, very slowly, in the manner used with antimeningococcic serum. The treatments should be at twenty-hour intervals if rapid improvement is not occurring. The amount is about 20 to 30 cc. immediately after that amount of cerebrospinal fluid has been taken. Flexner and Stewart have advised the hypodermic injection of human convalescent serum in the dose of 10 to 20 cc. to act as a prophylactic in the presence of an epidemic.

A serum obtained from horses is now on the market. If obtainable it *must not be given intraspinally,* because horse serum is prone to produce bad effects if so used. The horse is immunized by injecting into an animal at first the dead and then the living pleomorphic streptococci isolated from patients suffering from the disease. Flexner has, however, emphasized the fact that this form of horse serum has no real basis for value because there is no evidence that poliomyelitis is a streptococcal infection and that the use of this serum is pure empiricism. However, as some good results seem to have been obtained, the following text is allowed to stand from the last edition, the more so since benefit has followed the use of normal horse serum or even antipneumococcic serum in poliomyelitis. The serum is given intramuscularly; or intravenously. The dosage varies according to Rosenow with the severity of the symptoms and their modification after the first dose is given. If younger than two years of age 15 to 20 cc. are used, from six to twelve years 25 to 50 cc. and above thirteen years from 50 to 75 cc. It is usually best to give a second dose at the end of twenty-four hours even if great improvement has resulted from the first injection. As with all sera it should be warmed for intravenous use, given very slowly and precautions as to sensitization taken. (See Antitoxin and Diphtheria in Part IV.) The difficulty is that the onset of the disease is so sharp that damage is done by the infection before the serum can be used.

Antiscarlatinal Serum.

Great advances have been made in our knowledge of the etiology of scarlet fever, in its diagnosis, and to some extent in its treatment, chiefly through the studies of the two Dicks and Dochez.

Scarlet fever antitoxin is prepared by treating horses with gradually increasing doses of live cultures and filtrates of the streptococcus hemolyticus scarlatinæ until a certain degree of immunity is developed, taking the blood, separating the serum, concentrating it and standardizing it to the regulations of the U. S. Public Health Service. The unit for measuring the strength of Scarlet Fever Streptococcus Antitoxin is defined as the neutralizing power possessed by a definite quantity of Antistreptococcic Serum preserved at the Hygienic Laboratory of the United States Public Health Service under special conditions to prevent deterioration.

This quantity is equivalent to ten times the amount of Scarlet Fever Streptococcus Antitoxin necessary to neutralize one test dose of Scarlet Fever Streptococcus Toxin, each test dose containing five times the amount of Scarlet Fever Streptococcus Toxin necessary to give in the majority of non-immune individuals in twenty-four hours following intracutaneous injection, a skin reaction 1 cm. or more in diameter.

It is to be recalled that scarlet fever today, for some unknown reason, is, in the average case, far more mild than it was some years ago and that when it reaches a fatal result in a given case, this result is often due rather to the sequelæ than to the primary infection itself. As Bauer has recently pointed out, there occurred in 1924 and 1925 in Philadelphia, 8107 cases of scarlet fever with only 117 deaths and Toomey and Dolch report 6053 cases with a mortality of 50; none of these had specific treatment.

At present it would appear that antiscarlatinal serum is exceedingly useful and always to be employed in fulminant cases of scarlet fever with threatened or actual toxemia, but that it is a very grave question as to whether the serum should be given to every patient, since experience shows that in ordinary or mild cases properly taken care of, the mortality is no less when this serum is used than when it is not used. It is also prone to produce serum sickness some eight or ten days after its employment, and the point is to be emphasized that if it is to be used at all, it must be employed in the first few days of the fever, since after the rash fades it has proved of no value in influencing complications. This is believed to be due to the fact that the antitoxin neutralizes the toxin in the early stages, but later there is little or no toxin present requiring antitoxin, but that streptococci still remain and pathological processes in the kidneys, ears, or elsewhere proceed. For this reason, an attempt has been made to produce a serum which is not only antitoxic but antibacterial. When given to a toxic case it does not seem to materially shorten the course of the disease, but produces a marked temperature drop and renders the child more comfortable unless serum sickness develops. If a drop in temperature and fading of the rash fails to occur within twenty-four hours, a second dose should be given. As with diphtheria antitoxin so with scarlet fever antitoxin, it is best to give it in excess rather than in too small doses. For children the amount administered is about 6000 units. If the condition is grave, 10,000 units, and if extremely severe more than this.

It is a noteworthy fact that antiscarlatinal serum seems signally prone to produce serious reactions and that, therefore, tests should be made to avoid the danger of anaphylaxis, by finding whether a serum for any purpose has been given on a previous occasion whereby the patient has been sensitized, or to discover if he or she is naturally hypersensitive to foreign protein. (See article on Antitoxin for tests and Besredka's method.)

As scarlet fever is much less communicable than some other acute infections, antitoxin need not be employed as a prophylactic measure unless there has been direct contact or exposure. Where there has been such exposure and the child is under twelve years of age, it should always be employed (see below), but it is to be borne in mind that the protection lasts a relatively short time. At the Philadelphia Hospital for Contagious Diseases the following dosage of antitoxin has been used with excellent results when definite and immediate exposure to scarlet fever has occurred. In children up to four years enough antitoxin is used to neutralize 4000 units. Thus, in 172 cases which had been exposed, all of which gave positive tests (see below), not one developed scarlet fever and all gave negative skin reactions seventy-two hours later. When it is desired to produce immunity and there is no definite history of a recent direct exposure, the toxin has been used, but as with the toxin-antitoxin of diphtheria, it induces immunity too slowly to be employed after direct exposure in the very young. The prophylactic dose is about 2000 units.

When the individual is susceptible but has not been directly exposed it is better to induce a more persistent immunity by using the toxin of the disease called "Scarlet Fever Streptococcus Toxin for Immunization." This is given by subcutaneous injection of 1 cc. at intervals of five or six days for 4 doses, each dose being greater in strength. Dose 1 equals an amount of toxin 250 times greater than that needed produce a Dick reaction. Dose 2 equals 500 times, dose 3 equals 1000 times, and dose 4 is a strength equivalent to 2000 times the amount of toxin sufficient to make a Dick test. (See below.) Larger doses than this are prone to produce sore throat, rash, and fever but are probably more efficient in developing immunity. In each instance the bulk of the injection is only 1 cc. Two weeks later the skin test should be repeated to determine if immunity has been induced. (See below.)

If antitoxin has been given, the attempt to produce a prolonged immunity by the use of this prophylactic toxin should not be made for at least two weeks. It should not be given to one recently exposed and susceptible, as it does not protect quickly enough, as already stated, and if the disease develops, the patient suffers from the toxemia of scarlet fever plus the toxin injected. For this reason, also, prophylactic treatment by injecting toxin should never be used in treating scarlet fever which has developed. The use of the prophylactic treatment may cause local swelling and brawniness of the tissues with fever, general wretchedness and sometimes pains in the joints. In large dose it will induce scarlatinal toxemia and it will not give permanent immunity unless this evidence of toxemia develops.

Each of these prophylactic doses appears on the market in vials containing the strengths already named.

In the presence of an epidemic of scarlet fever, in a school or other institution, it is important to determine what individuals are not naturally immune to the disease, for a large number of individuals are so. This is done by a skin test identical with that of Schick (see Diphtheria) by intradermal injection. If an individual is not immune the antiscarlatinal serum should be used as a prophylactic. The so-called Dick test consists in the use of minute amounts of standardized scarlatinal toxin with a suitable diluent (1 to 1000 in normal salt). The degree of dilution may vary from 1 to 1000 to 10,000 or more according to the strength of the toxin. A control test is made with toxin detoxicated by boiling in a water-bath for two hours. One inoculation is made on the right forearm and the control on the left forearm. The injection is made intracutaneously, not hypodermically. Sometimes the control test is made with toxin neutralized by antitoxin, but is not so reliable.

The application of the Dick skin test may induce several types of reaction, only two of which are positive. The other two reactions are called negative and pseudo-negative reaction. When the patient is susceptible, in other words when the reaction is positive, the area injected with the diluted toxin within four to six hours presents an appearance like that of a positive Schick test at the end of twenty-four hours, but it is slightly more inflammatory than the Schick reaction. (See Plate V, Fig. 3, under article on Diphtheria). If the reaction is sharp it is called strongly positive (++), if less +. The red flush usually disappears in forty-eight to seventy-two hours. The control test may show practically no reaction at all, unless it be from protein susceptibility. In other words, occasionally the injected area may be slightly reddened from the presence in the injected fluid of an excess of protein. This represents what has already been referred to as pseudo-negative reaction. This test may also be employed to determine whether an individual who is ill and shows a rash has scarlet fever, measles or a drug rash, since if scarlet fever is present the reaction will be positive and negative in the other cases, but a negative test will not exclude scarlet fever. Aid in making a diagnosis may be had by taking a smear from the throat for in scarlet fever a blood-agar plate will show in twenty-four hours an almost pure growth of hemolytic streptococci.

This so-called Dick test to determine whether an individual is immune or susceptible is not entirely reliable, and my colleague

Bauer, Professor of Children's Diseases in the Jefferson Medical College, reports that in a large group of children who had been so tested, numerous cases of the disease subsequently developed although the test had been negative, and, further, that he got positive Dick tests after recent *bona fide* attacks of scarlet fever, in 12 to 20 per cent of cases.

To sum the matter up, therefore, antiscarlatinal serum should be resorted to combat toxemia if marked during the eruptive period of the disease, but too much confidence should not be placed upon the so-called Dick test in the sense that if a negative result is obtained the child can be considered positively immune.

When antiscarlatinal serum is employed to combat toxemia it should always be given intramuscularly, rarely intravenously, as its absorption after hypodermic injection is too slow. Only in the most urgent cases is the intravenous injection to be resorted to. Apparently the middle third of the anterior portion of the thigh is the best place for injection.

Antiscarlatinal serum may be used to differentiate scarlet fever from confluent measles and other exanthemata. This is done by injecting intradermally 2 to 5 drops. If the rash is due to scarlet fever the skin becomes blanched and remains so, not desquamating later as the rest of the skin often does. This is called the Schultz-Charlton reaction.

Antistreptococcus Serum.

As is well known, infection by the streptococcus produces the more severe forms of *septicemia* such as are met with in the puerperium, after injuries and operations (see Antierysipelatous Serum), and in association with such specific infectious processes as *scarlet fever* and *diphtheria.* In the latter diseases under these circumstances there is probably a double infection. While the theoretical basis upon which the use of this serum rests is good, the results from its use have not been so valuable, probably because in many instances the infectious process has not been solely due to a single strain of this microörganism but an infection by many strains. The best results have been obtained from its use in *puerperal* and *post-traumatic sepsis,* but only in the presence of well-marked and positive streptococcic infection would the writer resort to it. Its method of employment is identical with that of diphtheria antitoxin. Care should be taken to obtain the serum from a reliable manufacturer. It would seem probable that in some cases of *ulcerative endocarditis* this serum is the best treatment that can be used. The dose of this serum is usually 10 to 20 cc. every twelve hours, according to the age of the patient and the severity of the infection. Doses of 50 to 150 cc. have been given intravenously in severe cases.

Antitetanic Serum.

Antitoxin fails in many cases of tetanus because the tetanus toxin unites so rapidly with the cells in the spinal cord and brain that by the time the symptoms are present and the antitoxin is given the damage is past repair, and the antitoxic bodies cannot combine with the toxic bodies because they are already combined with the cells of the tissues. If tetanus antitoxin is given at the time the wound is received, it is as efficacious as is antidiphtheric serum in preventing diphtheria. (See Tetanus.) The point is to give it early and in large amounts. If any early symptoms are present, 25,000 to 50,000 units should be used at once; thus, 1500 units into and around the nerve running to the infected area, 20,000 units intraspinally, and 25,000 or 30,000 units intravenously. If the position of the vertebral column due to spasm prevents the introduction of the needle the patient should be relaxed by the use of chloroform.

These injections should be repeated every twelve or eighteen hours until improvement is marked. A blazing fire must be overwhelmed at once if life is to be saved.

The minimum dose as a preventive is 1500 to 3000 units, but it is to be recalled that the incubation may be from three to thirty days and it is safer to repeat the preventive dose every third or fourth day for 3 or 4 doses.

Tetanus antitoxin is official in two forms according to the U. S. P. Tenth Revision, namely, as *Antitoxinum Tetanicum* and *Antitoxinum Tetanicum Crudum.* The first must have a potency of 300 units per cc., the second not less than 150 units per cc., and the total solids must not exceed 20 per cent in either case. The unit of strength must be that of the standard tetanus antitoxin distributed by the Hygienic Laboratory of the U. S. Public Health Service. The rule as to date on the label is the same as that described under antitoxin for diphtheria. The crude antitoxin should never be used if the pure type is obtainable.

Because the *Bacillus perfringens* is very generally associated with the bacillus of tetanus many physicians think it wise to employ serum obtained from horses immunized against both organisms and this serum is now obtainable. It appears in syringe containers. As a prophylactic the dose is 1 syringeful repeated in twelve hours. For treatment 1 to 2 syringefuls are given every day. (See Antiperfringens Serum.)

A very careless custom has arisen among some members of the profession in that they call any biological or bacteriological product used by hypodermic injection a "serum," thereby confusing in their own minds and the minds of the laity antitoxins, vaccines, protein bodies of various types, and even glandular extracts. This carelessness is not only to be condemned because it is an error in itself but also because, as all these products depend for their activities upon the different effects which they produce in the body, the erroneous use of the word "serum" leads to an indefinite conception of how each product acts and leads not only to empiricism but to failure to get good results. A serum contains an antidote to a toxin, a vaccine (see Vaccines) stimulates the body to resist the specific germ present, and a glandular extract supplies the body with something which its own glands fail to produce in sufficient quantity for normal function. There is only one serum, properly so called because it is usually horse serum, which acts in a manner resembling that of a vaccine and that is antimeningococcic serum which as already stated is not an antitoxin but causes the cells in the spinal fluid, when it is given intraspinally, to devour more of the meningococci, in other words, it increases the phagocytic activity of the cells.

CLIMATIC TREATMENT.

(See Mineral Springs and Climates.)

COLD AS A REMEDY.

Cold, or the rapid abstraction of heat, is a remedial measure that is nearly always available, and is possessed of very great power for good in properly selected cases. We may divide its use into its local application, for a superficial, limited, deep-seated, or distant influence, and its general application for the purpose of affecting the entire body.

When cold is applied for its limited and local action, it is always used with two objects in view—namely, to cause localized contraction of bloodvessels which through inflammation are engorged so that the parts are reddened and swollen, or temporarily to anesthetize or benumb a nerve fiber for the immediate relief of pain, and with the hope that the temporary paralysis may ultimately result in such nerve-changes as to produce a cure.

Cold, in some form, is a popular remedy for a *burn* or *sprain* or any *injury* likely to be followed by *inflammatory processes*. In some cases, it is true, hot water or dry heat is equally efficacious, and this fact will be referred to when speaking of heat. (See Heat.) It may, however, be stated, as an almost invariable rule, that the choice of heat or cold is to be governed by the sensations of the patient (except in fevers), who will generally assert that one of the two is the more agreeable.

Cold or heat causes relief of pain in inflammation by producing contraction of the local bloodvessel walls. As a result, inflammatory exudates may not occur, congestion is relieved, and as the pressure on the nerve filaments ceases the pulsating pain of inflammation passes away.

In the treatment of localized pain or inflammation cold is used in a number of ways, largely depending in their choice on the will of the physician and the means of the patient. The simplest, cheapest, and perhaps the most efficient method of using cold is to place cracked ice in a pig's or sheep's bladder or rubber bag, and, after tying its neck to prevent leakage, to lay it over the inflamed part, surrounding it with a towel, so as to prevent the moisture, which appears on the surface from condensation, from wetting the clothing.

Where a very limited and comparatively transient effect is needed, chiefly for anesthetic purposes, it is customary in hospital and private practice to use a piece of ice sprinkled with a little fine salt, and held against the skin by means of a towel in the hand of the physician. Actual freezing can often be produced very rapidly in this manner. Where a more rapid method is desired, sprays of various very volatile liquids may be driven against the part by an atomizer. One of the most readily employed of these liquids is ether, which is fairly effective if it is used in a fine spray and driven against the skin in such a way as to favor rapid evaporation. Another of these agents is rhigolene, which is one of the lightest and most volatile of the liquid products of coal-tar, and is used in a spray from an atomizer in the same manner as is ether. Chloride of ethyl is a liquid largely used as a substitute for rhigolene as a local anesthetic through the intense cold produced by its evaporation. The fluid is directed against the skin over the involved area by means of a nozzle attached to the cylinder containing it. (See Ethyl Chloride.)

It is hardly necessary for the writer to repeat that, as the last three liquids are very inflammable, they should not be used near a light or fire.

Aside from the local effects of cold on inflammatory processes, it is largely resorted to for the relief of neuralgia of a superficial type, and has often been used for the cure of deep-seated *neuralgias*, as over the course of the sciatic nerve in *sciatica*. Generally, however, it is employed in neuralgia of the supraorbital nerve, where, owing to the superficial position of these fibers, the cold can readily reach them. The skin should be distinctly whitened and blanched, and even hardened, by the cold before its application is stopped, and if one application does not cause a cure, it may be repeated every day for several weeks in obstinate cases. Sometimes cold is used to benumb the skin or subcutaneous tissues in cases where a minor surgical operation is to be performed, but the pain of freezing an inflamed part is often as great as that of the operation itself without an anesthetic. Freezing is valuable when the physician is using the actual cautery, and in all these cases may be employed as is indicated above, except when rhigolene ethyl chloride or ether is used.

In *endocarditis*, and especially in *pericarditis*, the use of an ice-bag placed over the heart is a valuable remedial procedure, for it relieves palpitation and quiets the heart, decreases the pain and diminishes the inflammation. It is also useful for *cardiac palpitation* and for the rapidly acting heart of fever during the course of *pneumonia* or *typhoid fever*.

A hot bottle to the feet and cold to the head will often induce sleep in persons who habitually suffer from *insomnia*. This is particularly the case with those individuals who are wakeful from mental overwork. On the other hand, cases with insomnia from cerebral anemia do well if a cold plunge-bath is taken before going to bed, provided the patient is strong enough to have a healthy reaction, although in still other cases a hot bath is more efficacious. (See Heat.) The latter instances are not due to anemia, but to nervous irritability,

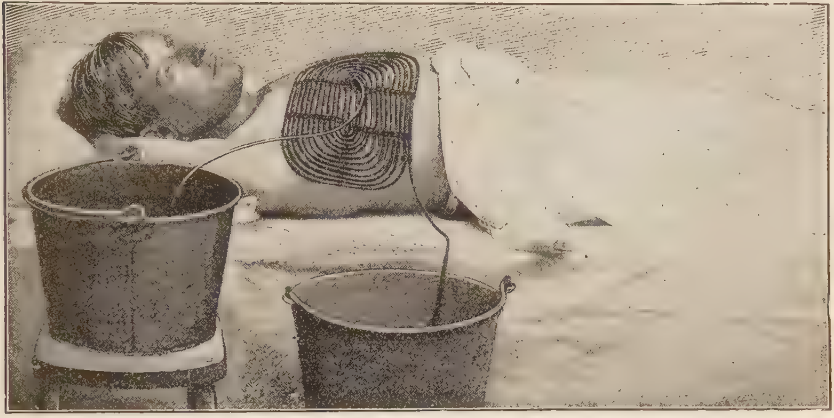


Fig. 65.—Showing the application of the cold-water coil to the chest. Applied to the left side it may be so used in pericarditis in place of the ice-bag. By suction on the lower end of the tubing a stream of water flows from one bucket to the other, and when the water has been transferred the stream may be reversed by changing the level of the buckets.

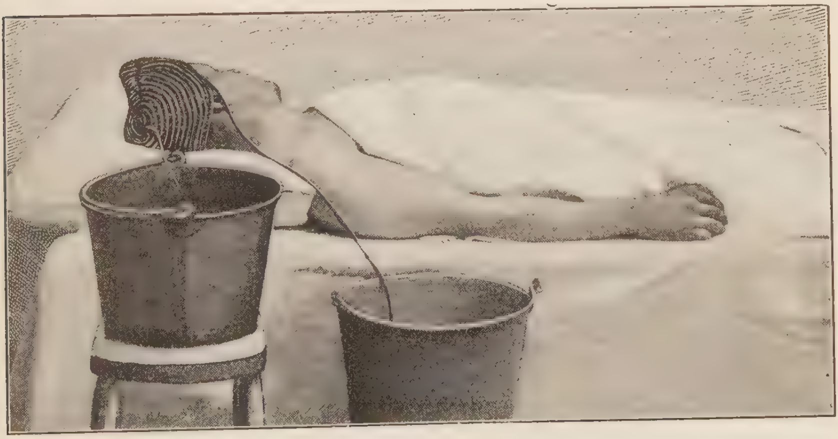


Fig. 66.—Showing the application of the cold-water coil to the head in cerebral congestion, headache, meningitis and in fevers.

which the heat quiets, whereas the insomnia of cerebral anemia is relieved by a cold plunge by reason of the increased circulatory activity and equal distribution of the blood produced by the bath.

When cold is to be applied to the head continuously, it is often convenient to employ a coil of rubber tubing and so shaped as to fit the vertex. One end of the tubing should reach to a tub of cold water on one side of the bed and the other to an empty tub on a lower level. By sucking on the lower tube siphonage is established, and as soon as the liquid has been transferred from one tub the full tub is raised, the stream is reversed, and the water passes back to its former receptacle (Fig. 66).

Bathing.

The use of a *cold bath* for the purpose of increasing the tone of the system is as old a custom as any which we have, but, like all other things in medicine, cannot be used without distinct indications for its employment, or, to speak more correctly, the absence of certain contraindications. The most universal exception to its use which we find is that class of persons with whom prolonged bathing of any kind, particularly when it is frequently repeated, does not agree. The writer is sure that a much larger number of persons belong to this class than is generally recognized, and he has seen cases of nervous exhaustion and general loss of vivacity and vitality occur as a result of too frequent bathing. This is the case more especially with daily bathers who soak themselves in hot or warm fresh water, particularly if the bath be taken in the morning.

Before passing on to the consideration of the physiological action of a bath, and why and when a bath should be used, it is proper to call attention to the fact that a very large proportion of children who are bathed daily are allowed to lie and soak in the tub, and as a result become debilitated and fretful, only to recover when a brisk bath is used once or twice a week, and replaced in the interval by a nightly sponging with salt and whisky or salt and water.

Through practical experience and much experimental research of a reliable character we now know that the following phenomena accompany the use of a cold bath in a healthy person with whom such a bath agrees:

On entering the water he shivers, thinks it almost unbearably cold, and he gasps if the cold suddenly touches the belly-wall or an equally sensitive surface. In a moment, however, reaction sets in, and the extremities, heretofore trembling and covered with *cutis anserina*, become warmer and flushed. The pulse is increased in force and frequency, and the respirations are deeper and more thoroughly performed. As a result of this each portion of the body receives a more perfect supply of blood and feels rejuvenated. Following this stage of exhilaration, a third stage comes on, in which the chillness and depression of the first stage recur in an exaggerated degree, but this condition does not ensue unless the person remains too long in the water. If he leaves the bath while in the acme of exhilaration, the stimulus may remain with him throughout the rest of the day.

The reason for the occurrence of this train of symptoms is not far to seek. The chilliness of the first stage shows that the great abstraction of heat is lowering the bodily temperature, the centers for calorification in the body not producing sufficient heat for the preservation of the normal temperature. At first the cold drives the blood into the warm recesses of the body, leaving the surface cold; but in a few moments the system is aroused to the recognition of the fact that it must increase its exertions in the propulsion of blood and production of heat, and so with an effort it puts forth its energies, picks up each corpuscle in the internal organs that is hiding from the cold, and, after imbuing it with warmth obtained by increased heat production in the sources of heat manufacture, forces it out to the surface of the body along with its fellows, which are driven to all parts of the system. This is not a mere figurative way of putting the matter, for cold primarily always contracts bloodvessels and reflexly stimulates the vital centers to increased activity.

When the bath is too prolonged, the result of overstimulation ensues, and the depression of the nervous system and circulation may be sufficient to interfere greatly with normal functional activity.

Just at this point it becomes clear why persons "catch cold," or, technically speaking, suffer from local or general congestions. An individual who is weak may never reach the stage of stimulation just spoken of, because his system has not enough units of force in it to expend them upon the functional activities named, and, as a consequence, the blood, which at the first shock has hurried into the internal viscera, is not driven back to its duty, but, sulking in its retreat like a deserting soldier, allows disaster and disease to ensue because its superior officer, the central nervous system, cannot gather together enough force or authority to make it do its duty. These cases present evidences, therefore, of circulatory and systemic depression or have congestion of the lungs, liver, or other parts. In the strong person exactly the same state of affairs obtains in the third stage of depression, but only after the strength of the system has been expended in the activity of the stage of exhilaration.

Cold salt baths, particularly if they are sea baths, are more stimulating and not so relaxing as is fresh-water bathing.

The use of a cold bath after a person becomes heated is popularly supposed to be dangerous. On the contrary, every athlete knows that nothing is so refreshing and so preventive of muscular stiffness after severe exercise and sweating as a cold plunge- or shower-bath; but he also recognizes the fact that a plunge is all that is permissible, and it is only the person who possesses the healthy circulatory power which will enable him to rebound from momentary depression to increased activity that should resort to such procedures.

The tonic effect of the so-called *drip-sheet* in certain neurasthenic cases is most marked. As has been pointed out, reaction must be produced, since it is by the stimulation of the circulation and its readjustment or equalization that good is achieved. The duration of the use of the drip-sheet and the temperature of the water in which it is wrung out are governed by the ability of the patient to react. Very feeble patients must be gradually trained by moderate means to the colder temperatures, and, if need be, may stand in a tub containing a few inches of warm water if there is a tendency to coldness of the feet.

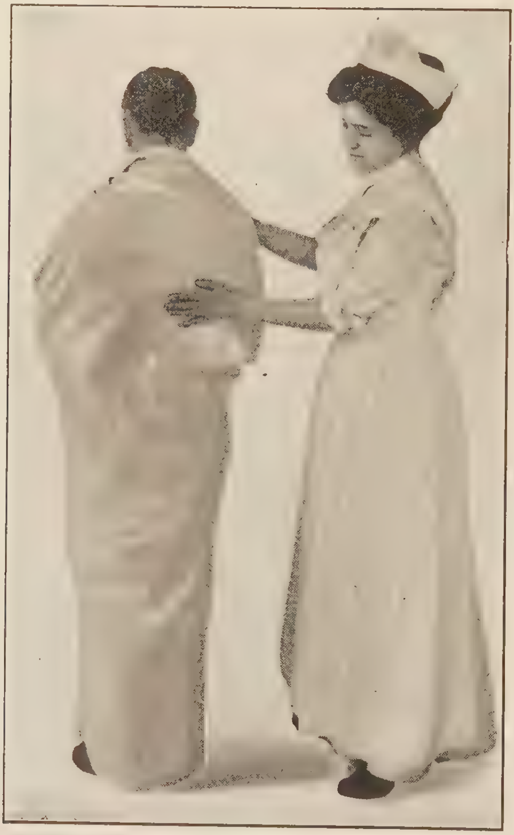


FIG. 67.—Drip-sheet wrung out and thrown about the patient, who rubs himself in front while the attendant applies friction to the back of the body and limbs.

The patient being stripped, the nurse takes a linen sheet previously dipped in water at any temperature that is not too low for reaction to take place, and throws it around the patient's body and over the head, so that in a moment the entire surface is in contact with it. Then the nurse applies brisk friction all over the patient's body and limbs, while the latter rubs the front of the body with his own hands. The whole performance is over in a few moments, and the patient should then lie down, be lightly covered, and rest. Such a drip-sheet will often be a cure for *insomnia* depending upon faulty cerebral circulation or nervous tension. In other instances it seems to be stimulating and to arouse dormant functions. Once a day is usually sufficiently often to use it, and when treating neurasthenics the morning is generally the best time to employ it unless it is designed to cause sleep (Fig. 67).

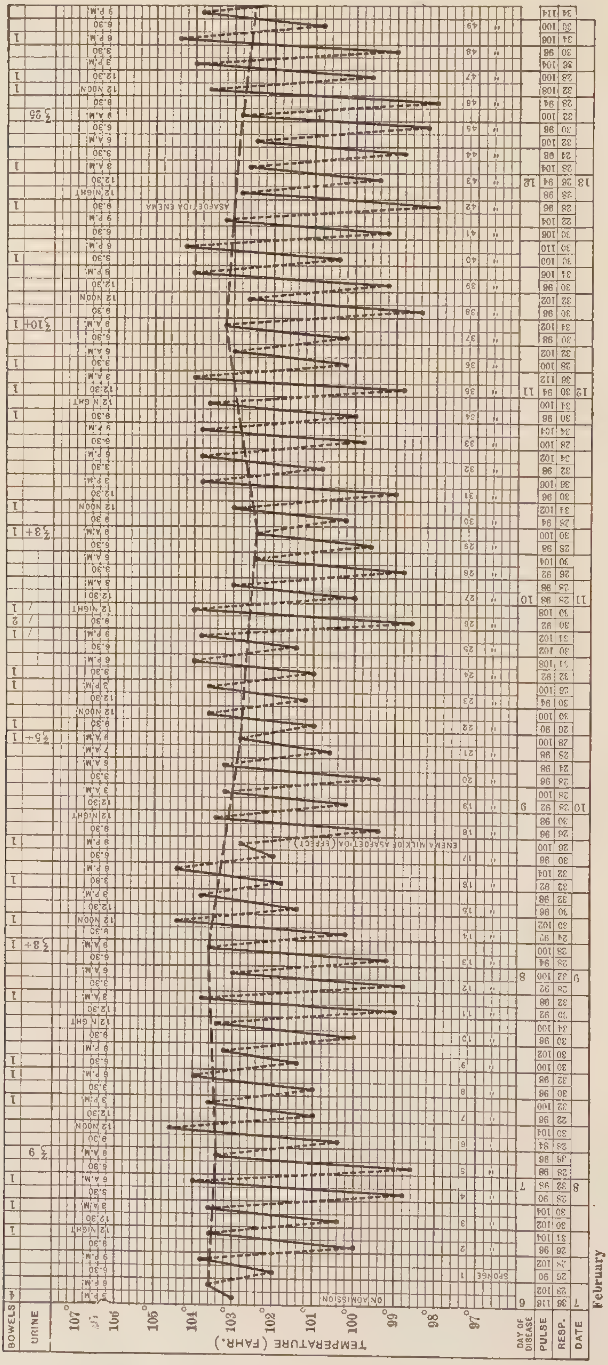
Cold Bathing in Fevers.

The proper manner to employ cold water externally in fever should be thoroughly understood. It may be used at varying temperatures, according to the effect desired, such as cool, moderately cold, and very cold.

Very commonly in the course of a fever the patient is restless, uncomfortable, and sleepless, yet has not a temperature fraught with harm. Such a case may be sponged with tepid water or with alcohol and water, or salt and whisky, with great benefit in the production of sleep, the reduction of fever, and the advantage of nervous quiet. Sometimes the sponging is successful when used only over the arms and legs, but more frequently it should be extended at least to the spinal column.

If tepid sponging does not lower the fever in a given case, then ordinary cool tap-water should be employed; and it is well to remember that the secret of successful sponging lies in the use of a sponge not saturated to overflowing, but only sufficiently wet to leave a thin film of moisture on the skin, which cools the patient by its rapid evaporation and does not wet the bed-clothes.

When we come to a study of the use of cold water in prolonged and severe fevers we find that its use is now universally recognized as the proper treatment if the patient reacts, and with good reason. At one time it was believed that all the good results from cold bathing were due to the reduction of the fever, but it is now known that this is the least important effect of the bath except when there is such a hyperpyrexia that there is danger from that source. The benefit derived from the external use of cold water in infectious fevers rests upon the stimulation of the vasomotor system and general circulation, so that local stasis or congestions of blood do not occur in vital organs, in the stimulation of the processes of oxidation and nutrition, and in the elimination from the body by the skin and kidneys of toxic materials. Further, the more frequent cleansing of the skin aids its normal function, prevents chafing and bed-sores, and lowers the temperature by aiding in the dissipation of heat.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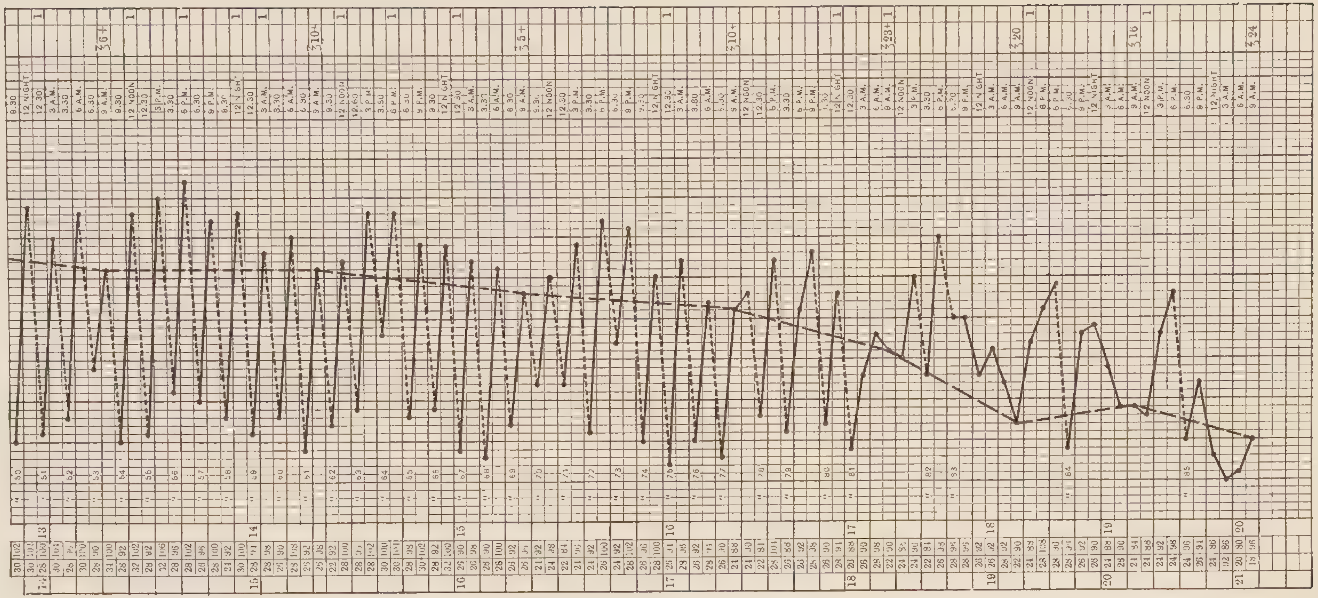

Fig. 68.—A typical chart from a case of typhoid fever treated by cold sponging. The dotted lines show the fall in temperature produced by the use of the cold water, and the solid lines the reaction after sponging. The horizontal broken line is the morning and evening temperature, showing that the bath exercises no permanent effect upon the fever, which in this case ended on the twentieth day. If a case of this disease fails to present these falls in temperature after the first week when sponging is used, it is evidence that the sponging is not given with water which is cold enough nor with sufficient friction. If, on the other hand, the temperature after it falls fails to rise, it is a sign that the power of reaction is absent, and tepid or warm water must be used with friction for several days until the reactive power is restored. This patient had eighty-five spongings.

Whenever cold is used for the reduction of fever and applied to the entire body, it should be applied rapidly and be accompanied by active rubbing of the skin of the entire body to bring the hot blood to the surface and to gain the valued effects of massage. As a rule, the water should be used at one temperature, and better results will be obtained if it is cold enough to produce something of a shock to the circulation and nervous system, for the effect sought is the production of a "REACTION"—that is, a redistribution of the blood and an awakening of all the vital processes. For this reason the writer does not approve of graduated baths—that is, the use of water which is gradually cooled while the patient is being bathed. The whole idea of the cold-bath treatment of fever is to produce the reactive stimulating effect sought by the well man who takes a sea bath. Consequently individuals too feeble to react should be bathed in slightly cooled water at first, and the temperature of the water reduced each day a few degrees until it is quite cold. The exact degree of cold depends upon the need of the patient as stated below.

Fever is to be reduced by cool sponging, in old and feeble patients using water at 90°, 80° or 70° F., according to the ability to react and the needs of the patient. Friction is to be used with one hand while the sponging is done with the other.

If the patient is a young adult and sufficiently strong to react, than the water used should be from 70° to 32° F., according to the needs of the case; and if the fever is persistent and difficult of reduction, the nurse may rub a piece of ice over the skin rapidly, applying friction constantly with the other hand.

The patient should always be stripped and laid on a blanket spread over a rubber sheet which has been placed to protect the bed.

It is essential when sponging is used that more of it be applied to the back than the front of the body, for at the back the great muscles and thick skin retain the heat, and these parts are not cooled if only the front of the body is sponged. Further, the posterior surfaces are the ones apt to be congested and sore from the dorsal decubitus, and therefore need the stimulant effect of the bath, as do the kidneys and other deeply situated organs. That this treatment is of value in those who react is shown by the marked redness of the skin, the improvement of the circulation and respiration, and the cleared mind.

The use of the *ice-rub* with a piece of ice weighing about 2 pounds held in the nurse's hand may take the place of the cold sponge of typhoid fever, and I have yet to see the case of typhoid fever, after the first week, in which this plan failed to reduce the temperature if it was properly employed. Indeed, I have learned that when this method fails it is because the nurse does not know how to use it. The rubbing with the ice and with the other hand must be brisk and produce reaction.

In some cases where sponging is not efficient the patient may be placed on a small canvas cot covered by a large rubber cloth placed by the side of the bed, which, by being raised at the head and depressed at the foot, forms a channel for the water. Over this, again, is placed an ordinary sheet. The patient, after being stripped, is laid upon this sheet, which is then folded over him, and a spray from an ordinary watering-pot for flowers allowed to play upon his body from head to feet. The temperature of the water depends upon the effect required. The cot should be so arranged that the water will not remain in puddles under the patient, but drain off into a bucket at the foot. The sheet being wet allows evaporation to go on, and a rapid fall in the fever results. It is of the greatest importance that the attendant lightly but briskly rub the patient all over with the hands during this bath, so as to bring the blood to the surface and prevent internal congestions.

The *Brand bath*, used in typhoid fever, consists in immersing the patient every three hours, if his temperature reaches 102° or 102.5° F., in a bath-tub of water at 70° F. and allowing him to remain there under friction for fifteen or twenty minutes, or until his temperature is reduced to 101° or 100° F. The patient will generally complain bitterly of the cold, particularly at first, and will also appear blue and chilly after the bath, but these signs are not so dangerous as they are alarming. If there be persistent and prolonged coldness after the bath, then hot bottles may be applied to the feet and a little whisky or brandy given.

During all kinds of bathing an ice-bag should be kept to the head to prevent cerebral congestion.

When the tub is used, it should always be placed near the patient's bed, so as to avoid unnecessary disturbance and muscular effort, for his strength must be conserved.

In using the Brand bath, a patient should be lifted with care and gentleness from the bed to the tub. The water in the tub should be deep enough to nearly cover his body, and yet not so deep as to float him in the tub so that he feels uncertain of his position and has to continually exert himself to keep his head above water. The lifting of a full-grown man into a tub, unless some mechanical aid is employed, requires several assistants, and, even when they are present, is very often a strain not only upon the nurses, particularly if a number of patients have to be bathed, but upon the patient as well. It is very important that patients should not exhaust themselves by making efforts under these circumstances.

On the removal of the patient the surface should be gently dried with towels, and the bed-clothing consist of only a sheet, or a sheet and one blanket in cold weather. Above all things, it must be remembered that the patient is not to be *wrapped* in a blanket, and not only this, but that he must not be rolled in a blanket while still in a wet sheet.

The wet sheet, if surrounded by a blanket, soon places the patient in a typical Russian or warm moist bath, calculated to raise instead of lower the fever.

When a patient comes under observation as late as the third week of typhoid fever the cold bath is contraindicated, as a rule, because the patient does not react, owing to his feebleness. If the bath is used from the beginning of the illness, it may be used all through the attack, as the system is then trained to react and is rarely so asthenic. Other contraindications are intestinal hemorrhage, nephritis, and great cardiac feebleness, but pneumonia is thought by some not to be a contraindication. With this view the writer disagrees. This bath is contraindicated in croupous and catarrhal pneumonia.

The fever of enteric fever does not readily yield under the use of the bath in the first days of its course, whereas that of other maladies usually does do so. This is an important differential point.

All cases of typhoid fever should receive the cleansing and reactive effects of sponging and rubbing at least once a day, even if the fever is not sufficiently high to need reduction.

Whenever cold is used in febrile cases a thermometer should be placed in the mouth or pushed deeply into the rectum, and the fall in the temperature watched. As soon as it reaches 101° or 100° F. the bath must cease, lest the fall continue, reaction fail, and collapse ensue.

Where sunstroke (thermic fever) is present the patient may have ice rubbed over his body or be put directly into a bath-tub of ice-water; but in any event the attendants must rub the patient's skin to bring the hot blood to the surface and prevent congestions. Cold water may also be injected into the bowel in cases where the skin is cold but the central temperature very high. (See Enteroclysis.)

Baruch, the apostle of hydrotherapy, has expressed some views in the following emphatic "Dont's," with which the author most heartily agrees:

Don't bathe with cold water to reduce temperature, but to refresh the fever-stricken patient.

Don't permit cyanosis or chattering of teeth; stop!

Don't stop bathing because patient complains of chilliness, unless the teeth chatter.

Don't raise bath temperature on the latter account; shorten bath and increase friction.

Don't neglect friction during every cold procedure; it prevents chilling.

Don't disregard the well-ascertained fact that the Brand bath (of 65° to 70° F. every three hours when awake, with active friction), is the ideal bath for typhoid fever *only*.

Don't give up cold bathing because the ideal bath is not obtainable; other procedures are useful.

Don't use the ice-coil to the abdomen; it has no refreshing effect and renders the skin beneath it cyanotic.

Don't lose sight of the fact that the chief aim of all cold procedures is reaction.

COÖRDINATED MOVEMENTS FOR TREATING LOCOMOTOR ATAXIA AND MYELITIS.

This plan of treatment is based upon the fact that great improvement in locomotion on the part of ataxic patients can be produced by causing the patient to make certain definite movements, the object of which is to reëducate his coördinating power. The power of coördination is lost partly by reason of the disease in the nerves and spinal cord, and partly because the patient has become bedridden, so that his otherwise healthy tissues waste from disuse. Definite exercises in such cases perhaps train collateral nerve centers and nerve tracts to do work not usually part of their function. In any event, such patients often greatly improve under this procedure.

It is vitally important that the various movements should be made slowly and with as great nicety as possible.

Exercises for the Lower Limbs.—The patient lies on his back on a firm couch and slowly lifts his fully extended leg until he touches with his toes the finger of an attendant, who holds his hand at a distance of from 18 inches to 2 feet above the bed. These exercises should be repeated several times with each leg.

Next, the patient completely flexes the leg on the thigh, and then the thigh on the abdomen. After this the limb is slowly extended until the toe once more touches the finger of the attendant, the leg being elevated at the same time that it is extended. After making this contact the extended limb is slowly lowered until it rests on the bed.

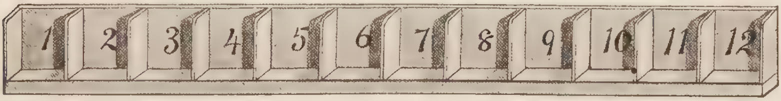

FIG. 69.—Showing the pigeon-holes into which the patient puts his heels when training his coördination and muscle-sense in locomotor ataxia.

A third exercise consists in having a board made with pigeon-holes attached to it, the tops of the pigeon-holes being taken off. A dozen of these holes should be made, and either lettered in the order of the alphabet or numbered consecutively. The patient lying on the back, with the heels resting in two of these pigeon-holes, is directed to raise a leg and to lower it so that the right heel will come down in the pigeon-hole named by the attendant; so that if the right heel is resting in pigeon-hole 1, it may be placed in pigeon-hole 4; and afterward the left heel, which may be resting in pigeon-hole 7, is placed in pigeon-hole 6. It will be readily seen that following these directions trains the coördinative faculty. The edges of the pigeon-holes should be smooth, and perhaps padded, to prevent the heel from being injured by striking against them.

The standing exercises consist in endeavoring to stand with the eyes closed and the feet close together, and in trying to stand on one foot with the eyes open or closed.

Another exercise is to paint a black stripe a foot wide across the floor of a room, and to direct the patient to walk along this stripe with or without support, being careful to keep his feet within its limits. He will usually do better with bare feet than if he has his shoes on. In taking this exercise the patient should be directed to bring the foot down in the natural position, and not upon the heel, as is so commonly done by tabetics; and also he must not evert the toes too much in walking, as is so commonly the habit. As the patient improves, the stripe upon which he walks may be narrowed.

The next walking exercise consists in going up and down stairs. It is well to build a flight of stairs, consisting of five or six steps, with a platform, which is so securely built that there is no danger of a fall. A balustrade or railing is put on each side of the steps for lateral support, and the patient is then made to ascend and descend the steps. Care must be taken that he mounts the successive steps by a proper contraction of his quadriceps rather than by pulling himself up by the aid of his hands. Many tabetics simply place the leg in a rigid position, and then use their arms to elevate themselves to the next step.

Still another exercise is to place the patient in front of an armchair and teach him to lower himself into the chair without touching the arms of the chair with the hands.

It is vitally important that these exercises shall not be continued until the patient is unduly fatigued. He should simply be slightly tired at the most, and usually one-quarter hour, twice or thrice a day, is a sufficient length of time for the treatment. Exhaustion is distinctly harmful under these circumstances. The patient should be urged to respond promptly to directions, as alacrity is important in training the coördinate faculties.

Somewhat similar exercises may be devised for the arms in cases where the upper limbs are ataxic as well as the lower ones.

COUNTERIRRITATION.

Counterirritation is a term applied to the use of substances irritating to the surface with which they come in contact, and is employed for the purpose of influencing morbid processes in more or less distant parts or of affecting the general system. It has been thought that this method savors of the doctrine of "like cures like," but in reality it is based on sound physiological laws.

The entire basis for the employment of counterirritation rests upon reflex action, or the conduction of a nervous impulse to a center, which, when so stimulated, sends out an impulse to the part of one body which is diseased.

The use of counterirritation may be divided into four parts or purposes: The first is for affecting inflammations or congestions; the second, for causing the absorption or removal of inflammatory deposits after true inflammation has ceased; the third purpose is for the relief of pain; and the fourth for the effect which can be exercised upon the general system by blisters in systemic disease.

In the same manner that we divide the indications for counterirritation into four parts, so can we also divide its forms into three varieties according to their severity. The most severe are the caustics or escharotics, the next the epispastics or blisters, and finally the rubefacients or reddeners. The caustics and escharotics have gone out of use.

The proper manner of employing a counterirritant to affect inflammation is not to apply it directly to an actually inflamed area, but a little to one side of it, or at a spot known to be connected intimately with the diseased area by nerve fibers.

Thus, it is well known that in diseases of the eye the blister should be applied back of the ear or on the temple, and that in abdominal neuralgia or in pleurodynia the best results are reached, not from the application of a blister to the spot where the pain is felt, but to the point upon the vertebral column where the nerve at fault takes its exit. The reason for this is that pain is always referred to the peripheral end of an irritated nerve, and pleurodynia or abdominal pain often arises from vertebral disease or inflammation about the spinal ligaments or the foramina

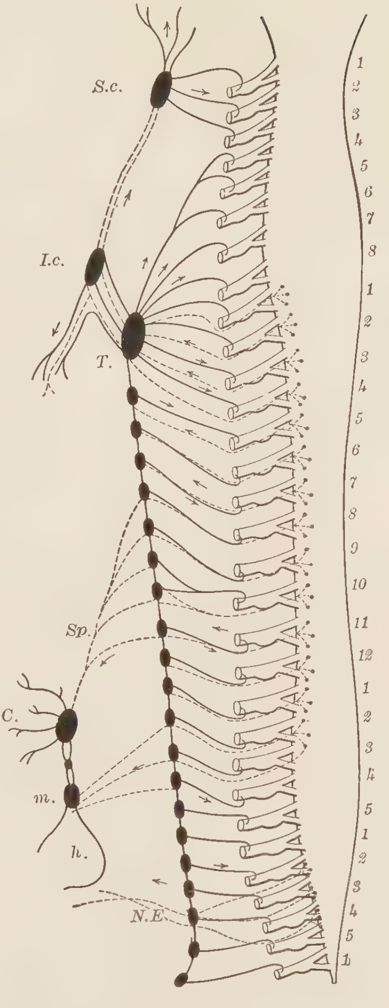

FIG. 70.—To illustrate the nervous pathways by which are exercised the effects of counterirritation. Diagram giving a schematic representation of the course of the autonomic (sympathetic) fibers arising from the thoracico-lumbar and sacral regions of the cord. The preganglionic fiber is represented in dotted lines, the post-ganglionic in solid lines. The arrows indicate the normal direction of the nerve impulses or nerve conduction. *S.c.;* superior cervical ganglion; *I.c.*, inferior cervical ganglion; *T*, the first thoracic ganglion; *Sp.*, the splanchnic nerve; *C*, the semilunar or celiac ganglion; *m*, the inferior mesenteric ganglion; *h*, the hypogastric nerves; *N. E.*, the nervus erigens. The numerals indicate the corresponding spinal nerves. (Howell's Physiology.)

of exit for the nerves. Counterirritation is contraindicated by the presence of any acute inflammation directly under the spot where it is proposed to place a blister; that is, if any reddening of the skin is present, the blister or other form of irritation must not be applied there. If used at all, it must be some little distance away, or a series of small flying blisters should be placed around the inflamed zone. *Flying* blisters are small in area—say as large as a Lima bean—and of comparatively slight action, the blisters healing rapidly after their primary effects have passed by.

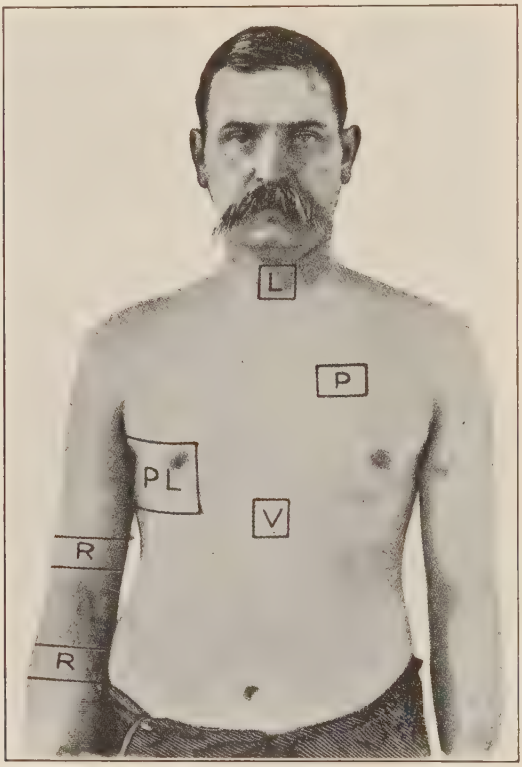

FIG. 71.—Showing the areas in which counterirritation is to be placed: *P*, pericarditis; *L*, laryngitis; *V*, vomiting or gastritis; *P L*, pleuritis; *R*, inflammation in joint.

For the removal of the products of inflammation resort is had to cantharidal blisters or drugs possessing powers as local irritants and at the same time as alteratives. Thus, in *pleurisy with effusion* it is very proper to employ a number of small blisters if the effusion has a tendency to remain unabsorbed, but if the pleural surface is covered with a fibrinous exudate the blister can do little good as far as the effusion is concerned until this is absorbed. Some have thought that the absorption which follows is due to the abstraction of serum which takes place in the bleb formed, but this is a mistaken idea, as one often sees an effusion absorbed which far exceeds in quantity the amount of liquid in the blister. Under these circumstances the spot for applying the blister is, as a rule, immediately under the arms about two or three inches below the axilla. The blister, while it is useful in causing absorption in chronic effusions and deposits about joints, is not so good as are alterative irritants; for example, iodine, which in the form of a thorough application at one sitting until the skin is black—not yellow or red—is often of service. In very chronic cases iodine ointment, alone or with lard, may be rubbed into the parts with advantage, care being taken to stop its use for a day or

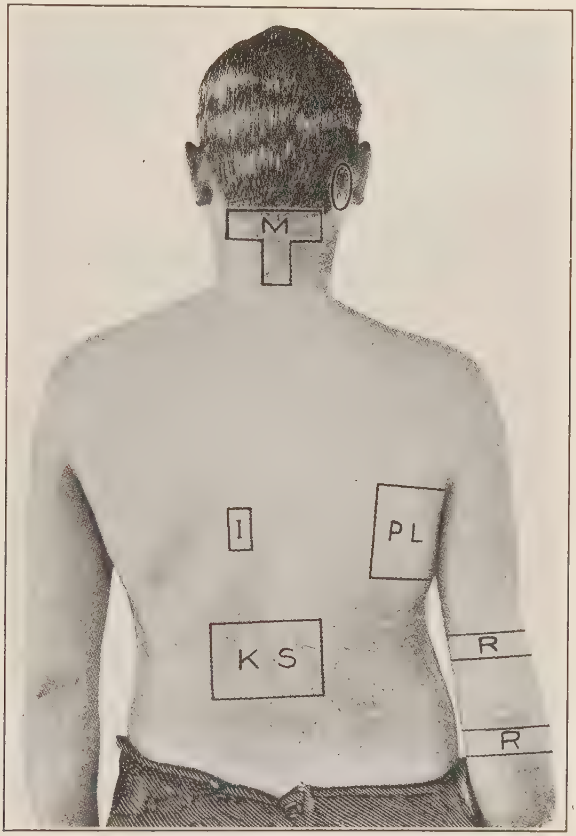

Fig. 72.—Showing the areas in which counterirritation is to be placed: *O*, earache or vertigo; *M*, meningeal inflammation or effusion at the base of the brain; *P L*, pleuritis; *I*, intercostal neuralgia; *K S*, renal or spinal irritation; *R*, rheumatism or inflammation in joint.

two as soon as the skin reddens. This same treatment is also useful in treating enlarged glands in the neck and elsewhere before pus forms. The treatment of acute and chronic inflammatory processes by blisters is not as frequently resorted to at this time as it formerly was.

Where blisters are small—that is, the size of the tip of a finger—they may be allowed to break of themselves, and then be dressed with dry cotton; if they are large, the blebs should be punctured at their most dependent part with an antiseptic needle and dressed with a sterile dusting powder covered by dry absorbent cotton, as by so doing the new skin rapidly forms underneath and is soon able to carry on its normal functions. The proper treatment of the blister while it is forming is to apply a poultice, which will decrease the pain and aid in the formation of the bleb.

One of the best treatments for *epididymitis* is to paint the scrotum black with several coatings of a strong solution of silver nitrate, or to use tincture of iodine, to insist on absolute rest in bed and to resort to the local use of cold. The testicles should also be supported by a suspensory or adhesive strips during this treatment, and aconite given if fever is present.

For the relief of pain resort is very commonly had to the rubefacients rather than epispastics, since the more moderate applications are equally effective in most instances, and do not leave skin lesions behind to remind the patient of his illness. When pain is present its degree is often exaggerated by its continuance, that is, the receptive cells become unduly sensitive by reason of constant irritation and pain impulses sent to other centers draws off or relieves those previously in trouble.

Every one who has had stomach-ache and remembers the relief obtained by the use of a mustard plaster or spice plaster recognizes the value of this means of obtaining relief, and *headaches* are often amenable to similar treatment. These headaches may be neuralgic or due to dyspepsia or to cerebral anemia or congestion, but counterirritation will nevertheless do good. A mustard or capsicum plaster may be applied to the forehead or to the nape of the neck. If neuralgic, a little menthol or oil of peppermint may be applied over the course of the nerve, which application, if it be supraorbital, will require care lest the oil gain access to the eye.

For the treatment of pain in the belly or chest or elsewhere we have four means of producing counterirritation in the shape of rubefacients: the first is mustard; the second, capsicum; the third, the turpentine stupe; and fourth, the spice poultice.

The mustard plaster should be made by mixing mustard flour with warm vinegar or water, and adding varying proportions of ordinary rye flour to modify its action. If the skin is tough, half mustard and half wheat flour may be employed; or, if a child is to be treated, the proportion should be only one-fourth mustard. The plaster is made by placing a piece of stout paper on a table and putting over it a piece of heavy muslin or linen. On this is smeared the mustard mass, and over this is placed a piece of thin linen, which prevents the poultice from adhering to the skin and modifies the burning according to its density. By folding the edges of the paper so that it resembles a picture-frame we have at hand a cheap, effective, and strong plaster, the back of which is supported by the paper.

The spice plaster is made by mixing equal parts of allspice, cloves, cinnamon, and nutmegs, and adding thereto one-half part of black pepper. These constituents are made into a homogeneous mass by using a knife-blade to mix them, and are then sewed in a bag which is quilted to prevent sagging of the contents. One side of the poultice is now wetted with warm brandy, whisky, or vinegar and applied to the part desired. If the skin is tender, the proportions of pepper and cloves should be decreased. This plaster may be allowed to remain over the affected part for hours or even days, and is very useful in the treatment of gastric catarrh and indigestion, particularly those forms occurring in children.

The turpentine stupe (see Turpentine) is not to be allowed to remain very long on the skin, as it may blister a tender cuticle, and the capsicum plaster may be so active as to produce unbearable pain.

The proper way of treating all burns from counterirritation is to apply simple cerate, petrolatum, or sweet oil, to which may be added carbolic acid in the proportion of 1 to 100. The carbolic acid acts not only as an antiseptic, but also as a local anesthetic, while the oil serves as a protective from contact with the air. When iodine burns excessively apply starch paste.

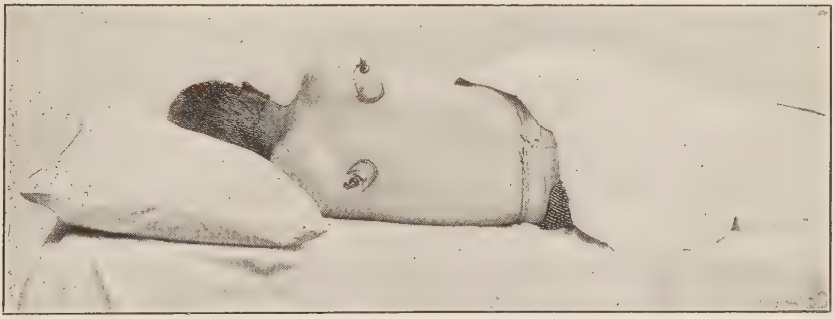

FIG. 73.—Dry cups applied to the chest, as in a case of pulmonary edema, the early stages of pneumonia, or diffuse bronchitis.

CUPPING.

Cups are used in two forms, the dry cups and the wet cups. The first depend almost entirely upon their counterirritant effect for their therapeutic value. A hollow glass bulb fitted with a valve or stopcock is placed upon the skin and exhausted by means of a small hand pump. The stopcock is turned to prevent the entrance of air and the cup allowed to remain until sufficient air leaks into it to overcome the vacuum and let it fall off. Several such cups placed over the bases of the lungs or kidneys relieve congestion and stasis in these organs. (For special areas, see Leeching.) Dry cups are often employed, and are valuable aids in treating the conditions named. Dry cups are not to be used in acute pleurisy lest they injure the parietal serous membrane.

A wet cup is applied as is the dry, but before it is placed on the skin the cuticle is incised by a scalpel in several places so that it will bleed freely when suction is produced in the cup. It is, therefore, both counterirritant and depletant, and is not to be used in feeble persons who cannot stand loss of blood.

DISINFECTION.

Before discussing the subject of disinfection, attention must be directed to what is meant by the terms employed when speaking of this subject. At present we recognize that the word "germicide" is applicable solely to agents capable of killing the lower forms of life, whereas "antiseptics" are substances which render material with which they come in contact so antagonistic or unsuited to germ development as to render it impossible, at least in an active state. To use a simile: the killing of the inhabitants of a district by shooting them would stop all growth and be germicidal, whereas the destruction of the crops in those same parts would only be antiseptic; or, in other words, the people might remain, but would starve to death. (See article on Antiseptics.)

We speak of germicides as disinfectants, but never of antiseptics as disinfectants if we use these terms correctly, but "germicide" and "disinfectant" are synonymous words.

From what has just been said, it is evident that when dealing with filth we should always resort to disinfectants rather than antiseptics, for although the latter are good, the former are better.

We have three ways of destroying germs which are particularly useful: The first is the total destruction not only of the germs, but also of their resting-place, by means of fire, which may be used in the case of old furniture, mattresses, and similar materials, and which may be extended to everything which has been about the patient if it is necessary to stamp out a brisk epidemic before it can get well under way; the second is the use of moist heat in the form of superheated steam, or, better still for common purposes, the use of boiling water; and, thirdly, by means of disinfectant materials which have a proved reliability.

Moist heat in the form of superheated steam is infinitely preferable to dry heat, but as superheated steam cannot be readily obtained, physicians usually direct clothing to be boiled for at least two hours.

Very often the bed-clothes are taken from a sick-room, trailed through the house, and finally deposited at any spot until a convenient time for boiling them occurs. This is radically wrong and capable of causing a widespread distribution of the disease. In all such cases the bed-clothes should be rolled off the bed in a bundle and completely submerged in a bucket or tub of boiling water, or, better still, in a corrosive sublimate solution of the strength of 1 to 1000, before they are taken from the room. This tub is now to be carried at once to the fire, and the clothes lifted out dripping wet and plunged into a clothes-boiler in which the water is actively boiling. The lid of the boiler is at once to be put on to increase the heat and prevent the escape of any germs in the steam or in the hot air which arises from the surface of the water. The active boiling should be continued for one or two hours, and water be continually added to prevent scorching the contents of the boiler.

It is important that food be not cooked on the stove at the time the clothes are being boiled, and no food should be in the room.

If boiling cannot be resorted to for any reason, the clothes may be soaked in a 1 to 500 solution of corrosive sublimate, or formaldehyde solution, although neither of these is so sure a method of disinfection as boiling.

The general trend of opinion during the last few years has been to the effect that there is little danger from the contents of a room after it has been occupied by a patient suffering from one of the acute infectious diseases, the chief precaution being to prevent the spread of infection by avoiding contact with the patient's discharges whether it be from the mouth, the anus, or the skin as in typhoid fever. Nevertheless the physician of today is hardly willing to put perfect faith in this view and the following text from the last edition is allowed to stand.

The care of a room after it has been occupied by a case of infectious disease is of great importance, and is generally sadly mismanaged. Disinfection is best accomplished by formaldehyde gas, which may be set free in one of two ways: namely, boiling the official solution by means of an alcohol lamp or other source of heat, whereby the gas is set free, or by the addition of permanganate of potassium to the official solution. The latter is a more expensive, but safer method, as it avoids the danger of fire in the tightly closed room. To satisfactorily disinfect a room containing 1600 cubic feet, 240 grams of potassium permanganate are placed in a large pail and 1 pint (500 cc.) of the official formaldehyde solution is poured upon it. This instantly results in a furious ebullition, which may cause the contents of the bucket, unless it is a very large one, to overflow. The volume of gas set free is so great that before the mixture is made the physician should have everything prepared so that he can at once leave the room. (See Formaldehyde.) The gas does not injure dyed stuffs.

When formaldehyde is used, the following rules should be followed:

1. All openings in the plaster or in the floor, or about the doors and windows, should be caulked tight with cotton or with strips of cloth or paper.

2. The linen, quilts, blankets, carpets, etc., should be stretched out on a line, in order to expose as much surface to the disinfectant as possible. They should not be thrown into a heap. Books should be suspended by their covers, so that the leaves are separated and freely exposed.

3. The walls and floor of the room and the articles contained in it should be thoroughly sprayed with water. If masses of matter or sputum are dried on the floor, they should be soaked with water and loosened. No vessel of water, however, should be allowed to remain in the room, as it will absorb the gas.

4. One hundred and fifty cc. (5 ounces) of the commercial 40 per cent solution of formaldehyde for each 1000 cubic feet of space should be placed in the generating apparatus.

5. The room thus treated should remain closed for at least ten hours.

6. One window, opening out of doors, should be left unfastened so that it can be raised from outside to let the gas out after the disinfection is completed. This will be more efficient if an electric fan can be started from a button outside the door. Several days often elapse before the room is habitable. The process of getting rid of the formaldehyde may be hurried by sprinkling ammonia water on the floor.

As an additional measure of disinfection all movable objects are to be taken out of doors into the fresh air, and then the floor, sills, and casings, are scrubbed with hot water, and soap. The water remaining in the bucket should afterward be boiled to kill the germs which may be in it. This scrubbing being accomplished, the same surfaces should be scrubbed a second time with a solution of corrosive sublimate (1 to 1000 or 1 to 500) and left wet, so that the mercury salt may remain on them. Cracks and crannies are to receive particular attention. After this is done the floor may be flushed with a solution of chlorinated lime. (See Part II.)

An essential disinfectant for all diseases is good ventilation. Not only should as much air as possible be allowed to enter the sick-room, but after the patient has vacated the premises the windows should remain open for weeks if possible. Fresh air dilutes germs as fresh water dissolves or dilutes dirt.

The question as to which are the best disinfectant substances is one that has attracted the attention of physicians and original investigators for years. The result of a vast amount of study and experience shows that formaldehyde in solution or in the form of gas is the best of all disinfectants (see also Formaldehyde, Part II), and that next to formaldehyde in value is corrosive sublimate in the proportion of 1 to 250 to 1 to 500, or even weaker, but that for cheapness, activity and general usefulness chlorinated lime is better still. The disadvantages in the use of corrosive sublimate lie in its ready decomposition, its formation of an inert albuminate of mercury when albumin is present, its inertness where lead pipes are present, and, above all, its expense. Chlorinated lime depends almost entirely upon its chlorine for any disinfectant power which it may possess. Chlorine gas itself is not readily handled, but the lime enables us to put it where we will. It cannot be employed to disinfect colored fabrics, as it bleaches them. None of these objections hold good against formaldehyde.

Whenever chlorinated lime is bought, the physician should see that all the chlorine has not departed from it, as much of the material kept in the stores is so old as to be almost worthless.

For scrubbing floors, chlorinated lime may be made into a solution by adding a cupful to a bucket of water, and in privies it may be spread thickly over the surface of the mass of filth.

It is useless to place chlorinated lime in saucers around a room for the purpose of disinfecting the air, as the amount of chlorine to the volume of air to be disinfected is as nothing.

Copperas, or sulphate of iron, while largely used as a disinfectant is in reality only an antiseptic.

Disinfection of the discharges of the patient suffering from an infectious disease is an important duty to be remembered. The urine and feces should always be received in a vessel containing enough corrosive sublimate solution (1 to 500) to kill all germs, and to prevent their escape into the air or into water or food when the discharges are thrown away. *The disinfectant should be placed in the bed-pan before, not after, it is used.* Masses of feces should be broken up.

The bed-pan or chamber should not be allowed to stand in the room, but be removed and emptied at once in such a manner that its contents cannot contaminate any water or food. Its contents should not be thrown upon the ground, as the air will dry them and cause the germs to be disseminated in the form of dust.

In very contagious diseases bathing or swabbing off the patient with weak antiseptics may be tried. Thus 1 to 10,000 solution of bichloride of mercury may be used and the patient afterward wiped off with a wet towel. In other instances a 1 to 500 solution of carbolic acid in sweet oil may be employed to soften the skin, allay itching, and disinfect the patient. This is sometimes resorted to in scarlet fever.

ENEMATA AND ENTEROCLYSIS.

An enema for an adult is rarely used in greater quantity than 8 ounces to a pint. Its object is to cause the lower bowel to expel its contents. An injection to medicate the rectum should rarely exceed 4 to 6 ounces. Very commonly an enema is employed to cause the expulsion of flatus and so relieve tympanites. The solutions used may be normal salt solution, soap and water, or olive or sweet oil, 8 ounces or 1 pint. In other instances 8 ounces of milk of asafœtida is employed which can be greatly increased in effectiveness by adding to it 1 dram of spirit of ether if the flatus is not readily dislodged. Another useful formula is ½ ounce of magnesium sulphate with 1 ounce of glycerin to 1 pint of water, in other instances oil of peppermint 10 minims to 1 pint of normal saline may be resorted to.

Enteroclysis, or the washing out of the bowel by means of large and slowly injected clysters for the purpose of medicating or cleansing the large intestine, has become one of the most valuable therapeutic measures we possess. It is of value not only for the purposes named, but also, for the maintenance of body heat by the use of hot water, and for the reduction of fever by the use of cold water.

The employment of irrigation of the colon is by no means of recent date. Aside from the fact that by this means we can bring medicaments in direct contact with the diseased mucous membrane, there is no doubt whatever that the mere passage of normal salt solution at suitable temperatures over the bowel wall is of of value, for in this manner we remove mucus and pus, and so dilute the poisons produced by the germs of the disease that their further action is largely inhibited. Irrigation in dysentery should be carefully carried out by means of an inflow tube, equipped with a return tube closed by a clip, attached to fountain syringe. The inflow tube should be introduced a considerable distance into the bowel. After the required amount of fluid has entered the bowel the clip on the return tube is taken off and placed on the inflow tube. By this means the injected fluid escapes.

The method employed in giving the injection, the temperature of the water and the gentleness of the operations are exceedingly important, and will be discussed below. The amount of water employed in irrigation of the bowel is not to be measured by quarts, but by results. It should continue to flow in until it comes from the outflow tube perfectly clear, showing that the object—namely, thorough cleansing of the bowel—has been accomplished. The medicaments to be added to the water are boric acid 1 to 20 or tannic acid 1 to 500, or potassium permanganate 1 to 20000, each of which is harmless and capable of doing much good. In nearly all instances in which we wish to cleanse the bowel a normal salt solution should be employed rather than pure water, as the latter tends to irritate the intestinal wall. (See Ipecac, Yatren and Cinchona.)

Intestinal obstruction is not to be treated by enteroclysis; the true indication for enteroclysis is obstruction due to impacted feces.

A very important point to be decided in connection with this subject is the amount of pressure that can be used with the stream of water which is employed, the length of time during which the injection may be given, and, finally, the temperature and character of the fluid injected, as a rule a pressure in excess of 2 feet is rarely advisable.

If a spastic state of the bowel is present water, at 108° F., may be employed, but when the intestine is atonic the temperature should be between 90° and 100° F.

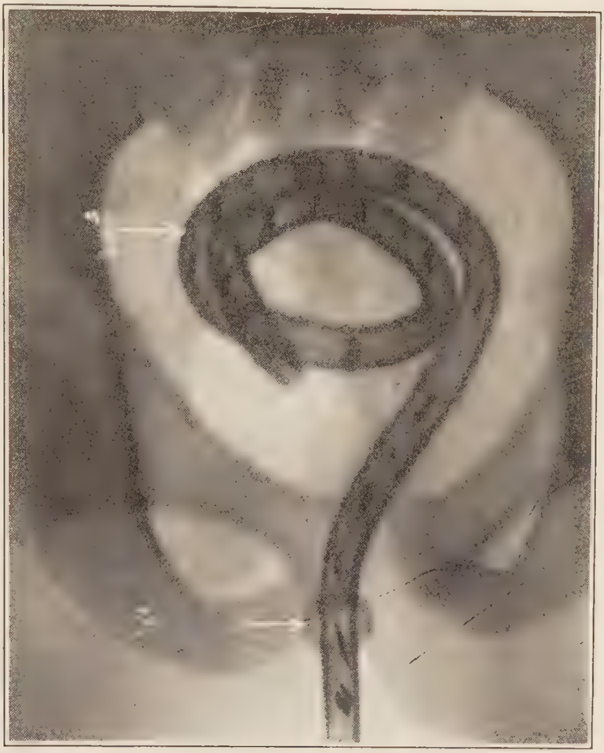

Fig. 74.—Showing how the rectal tube often coils on itself and therefore fails in function. (Manning.)

The dangerous practice of using a Davidson or any other kind of hand force syringe in the treatment of this class of cases is to be condemned. Several unreported cases of rupture of the bowel and death from the employment of the Davidson syringe for this purpose have occurred, because the amount of force used was indeterminable, and because the fluid was injected with a jerking instead of a constant flow. The amount of fluid injected should be large, and if it is impossible to get a large amount into the bowel, it is probably because the inflow has been so rapid as to excite intestinal opposition or the rectal tube is plugged by hardened feces or kinked.

Finally, the author cannot leave this subject with saying a word concerning the temperature of the injected liquid and its constitution. An injection of this kind goes into the very heat-citadel of the body, and if too cold, as it often is, produces dangerous chilling of organs which are ordinarily especially protected from cold by the omental apron and intestines. By repeated experiments, Martin and the author found that water at 65° F. lowered the bodily heat three degrees in thirty minutes. The use of colder water than this (52° F.) resulted in death in twelve hours, and the postmortem showed intense congestion of the colon, which contained bloody mucus.

The use of water of too high a temperature is also dangerous, lest it produce heat-stroke. Of course no one would use water hot enough to produce local harm, yet it is necessary to have just enough heat and no more. Martin and the author proved that the use of water at 115° F. caused in twenty-five minutes a rise of bodily temperature in the axilla of nearly five degrees, and developed marked symptoms of heat-dyspnea. The temperature which it is right to employ we found to be 101° to 103° F. as the water entered the bowel, or even as high as 104° F. in the water-bag if a long tube were used, as under these circumstances the water is rapidly cooled. An interesting result of these experiments as to heat is that when cold water was used it took four times as long to make the injection as when moderately warm water was employed.

If very large injections are used, a normal saline solution should be employed to avoid the abstraction of vital salts from the intestinal wall, with consequent passage of water into the tissues, making them boggy, due to the law of osmosis. If the saline solution is stronger than 0.9 per cent, it abstracts water from the bowel wall and causes irritation and thirst.

Rectal injections of hypotonic salt solution in the strength of 0.5 per cent are very useful to relieve thirst and to keep the kidneys active after abdominal operations and during the course of acute infectious diseases when there is scanty flow of urine and marked toxemia. (For the Murphy Drip or Proctoclysis see article on Peritonitis, Part IV; Nutrient Injections see Levulose, Part I; Feeding the Sick, Part III, and Diabetes Mellitus, Part IV.)

Studies by Garbat and Jacobi have shown that rectal injections cause an increase in the flow of bile from the liver, not the gall-bladder, thereby explaining why such injections often produce good results over and above the mere washing out of the rectum.

ERGOSTEROL.

(See Vitamines).

GAVAGE.

Gavage is a term applied to the forced feeding of patients who will not or cannot swallow food. The method is often employed in nourishing the insane who refuse food (Fig. 75). A soft-rubber catheter is passed through one of the nasal chambers back into the pharynx, a small funnel or syringe is attached to its outer extremity, and the milk, or beef-broth, or other liquid food is by this means introduced into the pharynx, where the muscles of deglutition seize it. The term gavage is also correctly applied to the forced feeding of a patient by an esophageal tube, as in the use of lavage. (See Lavage.)

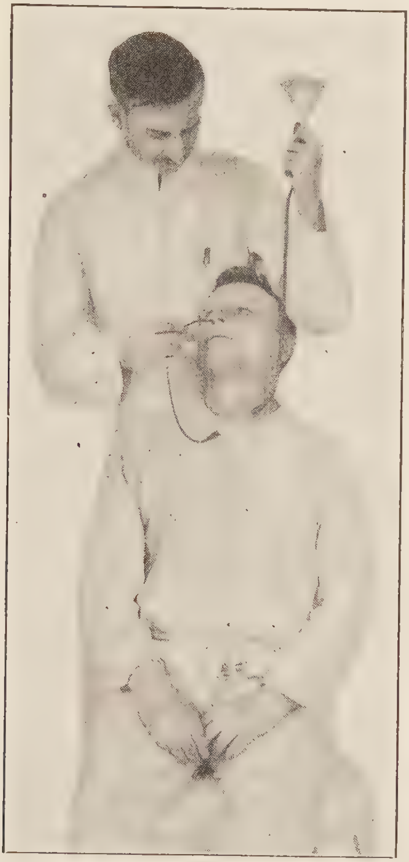

Fig. 75.—Showing the introduction of a soft catheter through the right side of the nose in the practice of gavage.

If the tube is allowed to remain in place and kept there by an adhesive strip attached to the cheek the patient may be fed every two hours if it is unwise to feed him three times a day. If the nasal passage is obstructed, shrink the mucous membrane with cotton wet with a watery solution of 3 per cent ephedrin, or adrenalin 1 to 5000, to which is added 3 per cent procaine.

The following diet used with success in giving gavage at the Jefferson Medical College Hospital may be employed.

A.—8.00 A.M.
Orange juice 4 ounces.
1 egg
Water 4 ounces.
B.—10.00 A.M.
Oatmeal gruel 4 ounces.
Cream 2 ounces.
Whole milk 4 ounces.
C.—12.00 NOON.
Beef juice 4 ounces.
Butter.
Gelatin, granulated heat and add water 5 ounces.
2.00 P.M.
Repeat "A."
4.00 P.M.
Repeat "C."
6.00 P.M.
Repeat "B."
8.00 P.M.
Whole milk 8 ounces.
Cocoa 2 ounces.
2.00 A.M.
Repeat "A."
6.00 A.M.
Repeat "B."
Olive oil, ʒj A.M. and P.M.
Whisky, ℥j A.M. and P.M.
Total calories in twenty-four hours, 2700.

HEAT.

Heat is used locally for a number of purposes in the same manner as is cold, and, as was stated in the article on Cold, the choice of heat or cold in the treatment of any acute form of inflammation depends almost entirely upon the wish of the patient, who generally can tell at once which will give him the greater comfort.

In *sprains of the ankle* nothing compares to a *hot* foot-bath prolonged for hours, the object being to decrease the pain and swelling, thereby regaining the use of the limb. The high degree of heat which can be borne by gradually increasing the temperature of the water by the addition of small quantities of scalding water is extraordinary, and the favorable results obtained are in direct ratio to the height of the temperature. Between these soakings the part should be dressed with lead-water and laudanum, and rubbed with ichthyol ointment or camphor liniment and laudanum.

In spasmodic affections involving either striped or unstriped muscular fiber the local application of heat is a very useful means of relief. Sometimes in *lumbago*, or muscular stiffness in other parts of the body, the use of an ordinary hot laundry iron over the affected parts will prove of great service, the skin being covered by several layers of newspaper to afford a smooth surface over which to pass the iron and to protect the parts from too great heat.

In *chordee* the best means for rapid relief, other than the use of drugs or general relaxants, such as chloral, is to steep the penis in hot water. A hot sitz-bath before going to bed is a good prophylactic against this painful complication of gonorrhea.

In *croup* of the spasmodic type the local application of a hot compress, made by wetting a stocking with hot water, is very useful, or several layers of flannel should be wetted, placed on the throat, and covered with wool and oiled silk so as to prevent the roll becoming chilled.

Nearly all forms of pain in the eyes can be much relieved by the application of heat. Thus *iritis*, *corneal irritation* and *ulceration*, and pain due to eye-strain can be greatly relieved by the use of *hot* water applied by cotton pledgets frequently renewed, but never allowed to remain on long enough to act as warm poultices. Another method is to allow water as hot as can be borne to drop upon the lids from a fountain syringe. The water-bag should not be more than 2 feet above the patient's head, and the fluid should drop on the eyelid from the distance of a few inches only. (See these diseases in Part IV.)

Where attacks of *dysmenorrhea* depend upon spasmodic closure of the cervix, with simultaneous spasm of the fundus uteri, a hot sitz-bath or hot vaginal injection is useful, and this treatment is also of value where uterine congestion results in leucorrhea or a sensation of weight in the pelvis.

Sometimes attacks of *torticollis* may be subdued by applying hot compresses to the sternocleidomastoid muscle.

The local application of heat may serve to determine whether the inflammatory process has gone on to the formation of pus. Before pus is formed heat decreases the pain, it is claimed by Lewin, but afterward greatly increases it.

Heat is largely used, when the skin or kidneys are torpid, to aid in the elimination of impure and effete materials from the blood and tissues. It is employed in two forms, the dry and the moist, commonly called the *Turkish* and *Russian baths* respectively, and may be taken under home arrangements or in one of the establishments found in all large cities.

The *Turkish bath* consists of a series of rooms ranging in temperature from 100° to 150° F. or more, into which the individual passes successively until the hottest room is reached. In each chamber he lingers until the system becomes accustomed to the high temperature, and perspiration is well established before he enters the hottest room, where he remains for a varying length of time according to the advice of his physician or his own whim or comfort. The rule governing his stay is that he must leave it at once if any sense of oppression is experienced or if perspiration does not flow freely. Sometimes a glass of cold water taken at this time causes a sudden profuse sweat, and also relieves any overheating by abstracting many units of heat. The cold water in the center of the body causes contraction of the bloodvessels in these parts, and the blood, rushing to the surface, causes the sweat-glands to pour out their secretion.

Following the stay in the warm room, the individual passes into still another chamber, where he is shampooed from head to foot well rubbed, and the blood made to circulate through the skin. The shower-bath is then used, at first hot or warm, and finally changed to a dash of cold, or, the patient plunges into a long tank, swims to the other side, and is there met by an attendant who rapidly dries his skin, wraps a cover around him, and shows him to a lounge, where he is supposed to sleep for an hour or so. The air of this sleeping-room is at the ordinary temperature of a living-room.

Reviewing for a moment the effects of this bath, we find that the first two-thirds are devoted to the opening and stimulation of the pores of the skin, while the last third is devoted to the contraction of these pores and their supplying bloodvessels. In other words, it is necessary to use the cold to prevent gradual chilling, which would result in internal congestion. If the patient receives a cold douche, the natural rebound prevents congestion of a permanent nature, whereas if he is exposed to cold a long time, these stagnated areas become permanently congested. The physician must always remember that this cold douche or plunge is a *sine qua non*, and that a rest after the bath before dressing is almost equally important. If the patient is too weak to bear the cold, it may be supplanted by an alcohol rub.

The indications for the Turkish bath as a medicinal measure in any condition of the emunctories of the body whereby effete matters are not properly eliminated, as in *Bright's disease* in its various forms. The increased action of the skin not only casts off some impurities, but the bath overcomes congestion and stasis and tends to equalize the circulation in the bloodvessels and lymphatics. It also tends to lower blood-pressure. In a case of Bright's disease the patient should not attempt to use the room containing high heat at first, and should be accompanied by a medical attendant to watch for untoward effects, particularly if the heart is diseased or uremia is already shown by headache or other signs. If sweating does not come on at once danger is at hand from acute uremia, renal and cerebral congestion, or heat-stroke. (See Electric Cabinet Bath.)

Not only is the Turkish bath useful for kidney disease, but it is often of great service in *rheumatism*. The acute form of rheumatism is never so treated, because cardiac complications forbid exposure to heat, and fever is generally present. In subacute and chronic rheumatism the case is different, and the enlarged joints or inflamed muscles greatly improve in some instances from such treatment. Further than this, the muscular stiffness following prolonged or severe effort can be so avoided, and *neuralgia* depending upon rheumatic or gouty taint may be relieved by the hot-air bath.

Acute colds affecting the nasal cavities or other parts of the body, at an early formative stage, can often be aborted by a thorough Turkish bath, and when further developed are often greatly relieved by the same means. If, however, congestion of the lung, pneumonia, or chronic bronchitis, with emphysema or a dilated weak heart, is present, the bath may be dangerous. In *acute pharyngitis,* in which the pharynx feels like a raw surface or "as if it were filed or scraped," the bath will give relief in many instances.

Sometimes in *suppression of menstruation* from cold the flow may be restored by a Turkish bath.

Some persons complain that they are always catching cold upon the slightest exposure and apparently without cause. One class seem to have delicate mucous membranes readily susceptible to irritation and inflammation; the other have dilated or relaxed peripheral capillaries, which readily allow the blood in them to become chilled, and the individual consequently suffers from internal local congestions. Two separate means of treating such cases exist: The first class will do well on minute doses of arsenic trioxide (grain $\frac{1}{100}$ to $\frac{1}{50}$) three times a day, used for weeks; the second will be cured of their habit by the use of a Turkish bath twice or thrice a week, since by this means the peripheral capillaries are toned up and made more active.

The Turkish bath, as thoroughly carried out in large cities, is not obtainable for those living elsewhere, so it is well to describe a home modification which, with attention to detail and care, may prove almost, if not quite, as effective a remedy. (See Figs. 76 and 79.)

The patient is placed upon a wooden chair, naked, and under the chair a small alcohol lamp is put, which is lighted. The individual is now wrapped thoroughly, chair and all, in a sheet and one or two large blankets, when the heat of the lamp soon causes profuse sweating. Many cases are, however, on record where the lamp has been upset and the patient badly burned. The best way is to have the lamp a little to one side and its flame immediately under the mouth of an inverted funnel attached to a piece of tin tubing, the free end of which is placed under the blanket, so that the hot air and vapor may surround the body. If the tube be covered with cloth, the loss of heat is slight and the danger of burning the patient is removed. If this is not practicable, several very hot bricks or stones, thoroughly heated in an oven, may be placed under the chair, or small heated logs of wood may be substituted.

When the patient is too feeble to sit in a chair, then it is wise to place an alcohol lamp at the side of the bed, with an inverted funnel attached to a tube which passes under the bed-clothing in such a way as not to bring the hot air directly against the skin of the patient. The bed-clothing may be slightly raised to allow the hot air to enter. The vapor of the alcohol lamp tends to sweat the patient. This is also a valuable mode of using external heat in cases of shock (Fig. 76).

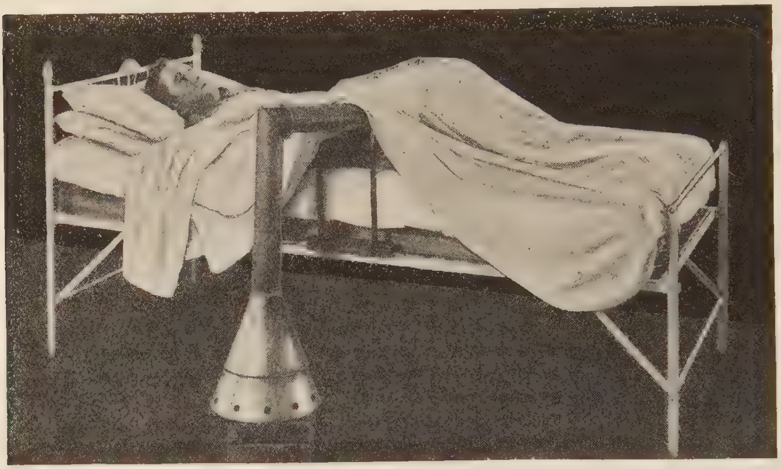

Fig. 76.—A method of giving a bedridden patient a hot-air bath where a sweat is desirable, or where shock with a collapse temperature is to be controlled. The bed-clothing is raised by a cradle. An alcohol lamp is placed under the inverted funnel, and the hot air is carried in this way to the patient without any danger of fire or burning the skin by hot bottles.

A modified form of Turkish bath, now commonly resorted to, is the electric cabinet bath. It is more suitable for those who are ill than the Turkish bath. This consists of a box large enough for the patient to sit in on a stool after he is stripped. His head projects through a hole in the lid and a towel is placed around his neck to keep the hot air in the cabinet from escaping. The box is lined with 20 to 30 incandescent lamps so that when the electric current is turned on they give off a great amount of heat and within a few moments the temperature in the cabinet may be 120° F. By reason of the stimulating effect of the light upon the skin the patient sweats as freely at 120° F. as he would in a Turkish bath at 130°, and therefore is not exposed to very high oppressive heat. Furthermore his head is not heated, but kept cool by cloths wrung out in ice-water, and, as he does not inhale hot air, his lungs are not exposed to great change of temperature when he goes out of doors. This, he should not do, however, in any event before one or two hours. After being in the cabinet fifteen to twenty minutes he is found to be sweating

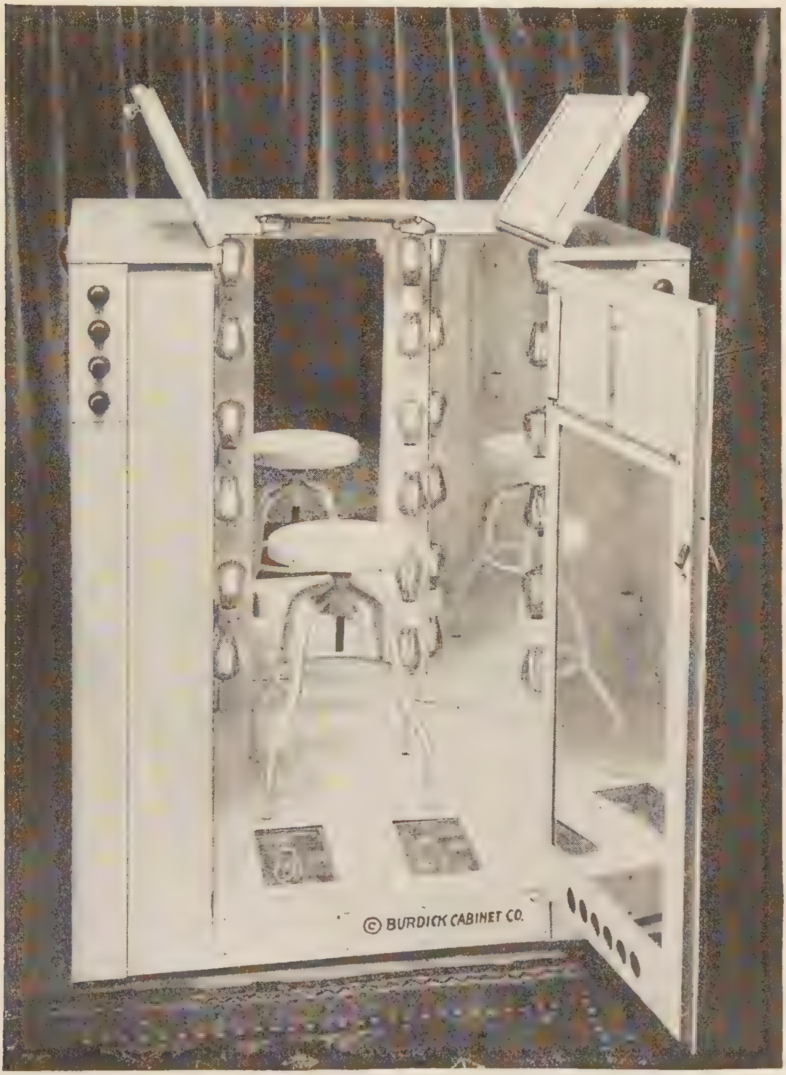

FIG. 77.—Electric light bath cabinet.

freely. He is then allowed to get out, is rubbed down with tepid water and soap, and finally with alcohol and water, and after this should lie down lightly covered and cool off gradually. Although he should be dried with a towel he should not be rubbed with it, as this again dilates the skin vessels and induces further sweating. When an electric cabinet is not obtainable, a folding frame covered with rubber sheeting may be obtained from any instrument maker and the heat supplied by an alcohol or other lamp or a Bunsen burner. A similar apparatus shaped so that it covers the patient when lying in bed can also be had for patients too weak to sit up.

The *Russian bath* differs from the Turkish in that the heat used is moist, not dry. As a consequence the danger of heat-stroke and similar states is much increased, because evaporation from the skin does not go on so rapidly and the body is not cooled so well.

The hot moist bath can also be obtained by seating the patient on a wicker chair under which is placed a bucket of hot water. The patient is surrounded by a blanket, and a large hot iron or stone is put into the water, causing the development of a great amount of steam.

This method of treatment is useful in the same states as is the Turkish bath, but is more rarely used.

Although these baths have been used in the treatment of cases of heart disease to relieve dropsy and renal engorgement, they are not safe, and should not be generally employed. All acute or chronic diseases of the lung, except acute bronchitis of a mild form, contraindicate their use.

Under the name of the "*hot pack*" still another substitute for the Turkish or Russian bath is used, not only to cause sweating and so relieve the patient suffering from renal disease, but also relax *muscle spasm* and to relieve *nervous excitement* and *nervous insomnia.* It is particularly efficacious in the *insomnia* of *severe chorea* in children, and may be used in *tetanus.*

A bed is prepared by covering it with a rubber blanket. Over this is placed a dry woolen blanket. A large heavy blanket is now dipped in very hot water and then wrung out (Fig. 78), and the naked patient quickly wrapped in it, the dry blanket being folded over him after several hot-water bottles have been placed alongside the patient. Finally the sides of the rubber sheet are drawn around and over the patient and an ice-cap placed on the head (Fig. 79). A thermometer should be placed in the mouth every fifteen minutes, and if the patient's temperature becomes febrile (101° F.) he should be taken out of the blankets and rubbed dry. Ordinarily the bath should last about one hour, and if sweating does not speedily come on a glass of cold water should be taken to drive the blood to the skin. In adults a little gin may be added to it, or sweet spirit of nitre may be used in this way in children and adults. If no sweat develops and the temperature begins to rise, the patient must be taken out of the bath at once. The hot pack is contraindicated if there is any tendency to pulmonary edema.

The *mustard hot pack* is often useful in the treatment of internal congestions and particularly so in the infections toxemias of infants and children. It is to be employed as follows:

Oil of mustard, 10 minims (0.65), is thoroughly mixed with a pint (500 cc.) of alcohol and water in equal parts, the water being heated before the mixture is made. A large piece of flannel is saturated with this mixture and the child is wrapped in it from the neck to the feet,

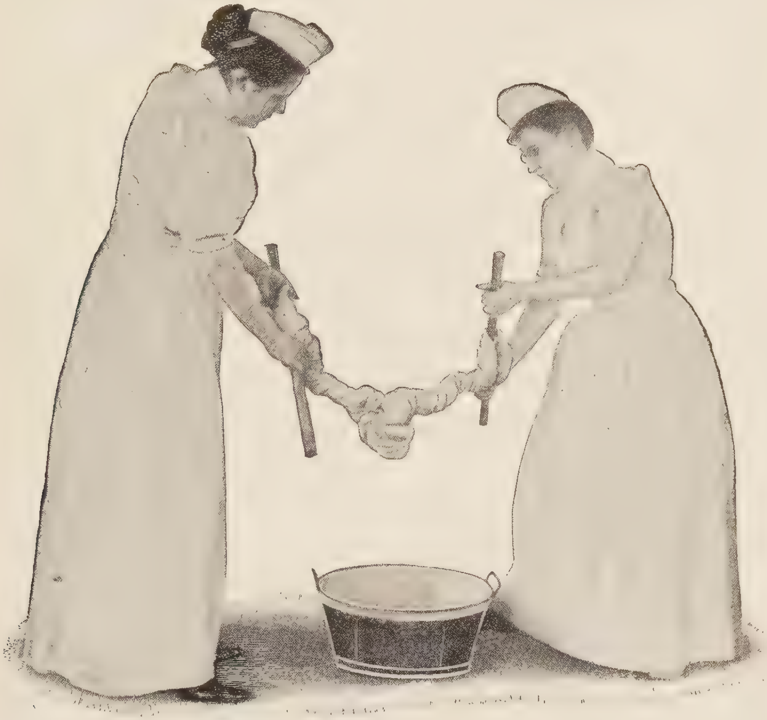

Fig. 78.—Nurses using two broom-sticks to wring out a blanket dipped in very hot water for use in the hot pack. (From the author's wards.)

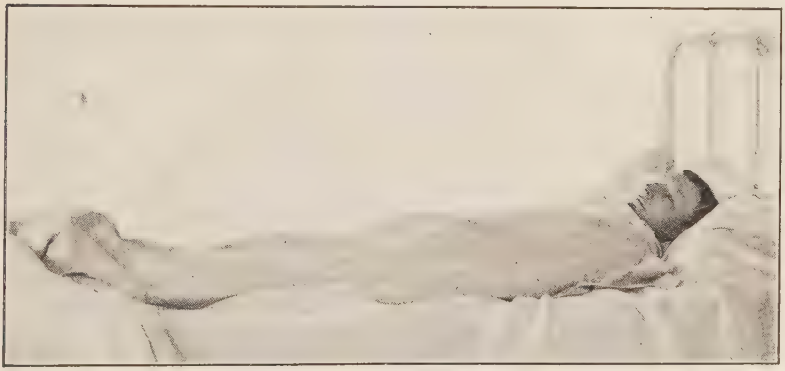

Fig. 79.—Showing arrangement of blankets in giving a hot pack for uremia. (From the author's wards.)

and then, in turn, wrapped in a thin blanket. After the lapse of ten to twenty minutes the skin will be found to be bright red, and the flannel is then taken off and the child wrapped in another piece of flannel which has been wrung out in a mixture of alcohol and warm water in the proportion of 1 to 2 parts. In this second wrapping the child lies for one-half hour, after which it is again wrapped in a dry blanket or, if the weather is warm. in a dry sheet. The mild counter-irritant effect of this application draws the blood from the congested lungs, and in the case of eruptive fevers, in which the eruption is not fully developed, it will frequently relieve nervous symptoms and develop a rash. If there is reason to believe that the child's skin is exceedingly sensitive, 5 minims (0.033) of the oil of mustard instead of 10 minims (0.65) should be employed.

Another wet pack, which speedily becomes a warm one, is used in cases in which, during the course of an *eruptive fever*, the eruption fades and it is desired to bring it out on the surface. It is also useful in those cases of severe *chorea* in which the child can withstand the first shock of the cold. It consists in wrapping the child in a cool wet sheet and over this wrapping 1 or 2 blankets. In a few minutes the sheet becomes heated by the body and the sweating which results is profuse.

A valuable method for using moist heat in a mild form is the "*bronchitis tent.*" (See article on Bronchitis.)

The use of a high degree of *dry heat* for the cure of inflammatory states of the sheaths of the joints and muscles consists in the employment of a double copper cylinder closed at one end, inside of which is placed the limb which is affected. The limb is prevented from coming in contact with the cylinder by means of a board padded with asbestos and by putting pads of linen under the parts which would touch the asbestos. A thermometer is placed so that its bulb extends into the cylinder, and a few holes permit of the moderate circulation of air. Bunsen burners or alcohol lamps are now lighted and placed under the cylinder, and the orifice through which the limb enters it is closed by drawing around the limb an asbestos curtain. The temperature is allowed to rise to 200° to 300° F., and the treatment resorted to daily, or several times a week, the individual *seance* lasting about one hour. The free sweating of the limb and the circulation of the blood and lymph prevent it from being burnt, but care must be taken that it does not touch the metal. Usually the entire surface of the body sweats profusely during the sitting.

The author believes this method to be of great value in cases of chronic inflammatory joint affections due to *rheumatism* or following injuries, but of little service in those due to gouty swelling. In subacute gout he has seen it precipitate an attack of universal acute gout, apparently by setting free large amounts of urates from the affected joints.

This method of treatment is always to be considered as a valuable aid in the treatment of the more obstinate cases of the character described.

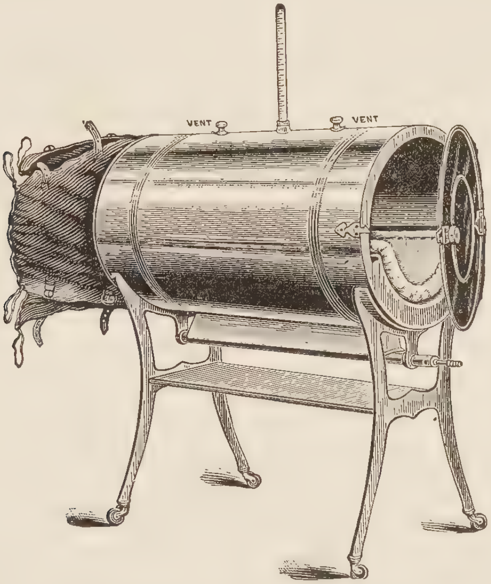

Fig. 80.—Frazier-Lentz hot-air apparatus.

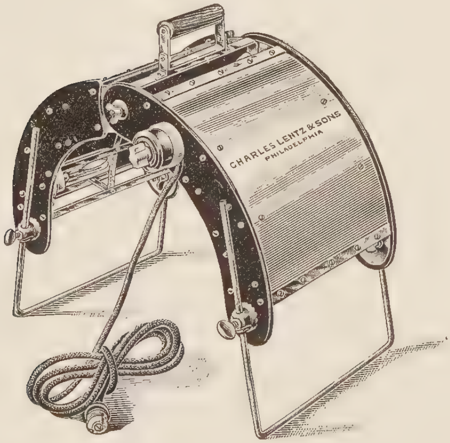

Fig. 81.—Electric Heater for painful joints.

A much less efficient, but widely used, apparatus is one in which a number of electric lamps are placed inside an inverted trough of metal. The lamps should have carbon filaments. The area or leg is covered with some fatty substance to protect the skin and the current turned on the lamps after the apparatus is put in position. (Fig. 81.)

Other methods for the local use of heat and the use of the so-called thermolite lamp or, better still, the employment of the zoalite lamp whereby the infra-red rays, which have notable penetrating power, can be utilized. Larger lamps than that shown in Fig. 82 can be used to heat the entire body.

Heat may also be applied locally, or generally, by the mercury quartz lamp with its ultra-violet rays.

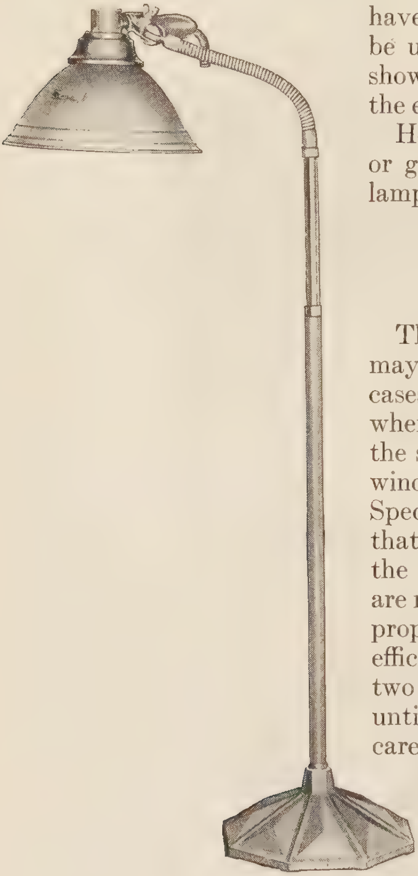

FIG. 82.—The Z-12 Zoalite.

HELIOTHERAPY.

The employment of heliotherapy may be wisely resorted to in many cases of tuberculosis be the lesions where they may. The direct rays of the sun not filtered through ordinary window glass, are to be employed. Special glass is now made for windows that does not prevent the passage of the ultra-violet rays. If these rays are not available the ones afforded by proper electrical apparatus are very efficient, but exposure for more than two minutes may cause a severe burn until the skin is well tanned.[1] Great care should be taken not to try this treatment in cases with marked fever and that a very limited area of the body or limbs are exposed in the early treatments or sharp reaction may ensue. The following course may be pursued:

First day: Protect eyes and head as well as the body and expose the feet, for only five minutes, three or four times a day.

Second day: Repeat the above except that the time is ten minutes as to the feet and five minutes to the legs.

Third day: Repeat except that the feet are exposed fifteen minutes and the legs for five.

Fourth day: All the previously named parts are exposed five minutes and the abdomen as well.

Sixth day: Repeat, but add exposure of chest.

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[1] For the special employment of artificial ultra-violet rays consult special books on this subject.

By the ninth day repeat as above and turn the patient prone and expose back for five minutes. After this each day increase each exposure by five minutes until all parts are exposed for three or four hours. Each case is a rule unto itself. It is often wise to advance the exposures more gradually. A measure of dosage is the degree of tan induced. The deeper the tan the longer may the exposures be maintained. In those who tan little the treatment must be very cautiously used. If they fail to tan at all the treatment should stop.

Watson, of Tucson, Arizona, gives the following excellent rules as to heliotherapy in tuberculosis.

In cases of extrapulmonary, or so-called surgical infections of the external lymph glands, bones, joints, and peritoneum, use sun treatment in all cases, unless there should be an associated pulmonary lesion, when this statement should be modified to the extent of being very careful to avoid reactions and still more careful in regard to exposing the chest to the sun's rays.

In cases of infection of the lungs and tracheo-bronchial glands in children, if the conditions are gradual in onset and not severe, the sun treatment may be used in all cases, but if the patient be an adult, resort to sun treatment only in those instances which in spite of the best hygienic and dietetic treatment remain in a stationary condition or lose ground.

Most important of all in the way of contraindication is the type with sudden onset, active progress and severe symptoms. In all patients presenting this type of infection of the lungs and tracheo-bronchial glands, whether the patient be a child or adult, Watson believes that sun treatment is never to be resorted to and he further states that heliotherapy used in any type of tuberculosis must always allow the patient to feel the same, or better, both during and after his sun bath. If not stop it.

Heliotherapy is also used with great advantage in children with tuberculous lymph nodes. So too in rickets it is a most efficient remedy. When sunlight is not available rickets should be prevented, or treated, by artificial sunlight or ultra-violet ray apparatus. (See Irradiated Ergosterol under Vitamines.)

As indicative of the ill effect of lack of the sun's rays it is found that there is a marked increase in the prevalence of rickets in children living in cities, during the winter months.

HEMOSTATIC SERUM.

Hemostatic serum or "hemoplastin" is a sterile derivative from blood. It is used to control persistent hemorrhage from small vessels which cannot be occluded by ligation or compresses, as after operation in certain cases and in the hemorrhage of the new-born, and in hemophilia. In other words its particular field of usefulness is in cases characterized by delayed coagulation.

The principles involved in its action are as follows: The blood contains all the elements needful for coagulation (chiefly prothrombin), but is prevented from clotting by the presence of antithrombin. If the blood escapes from its vessels it comes in contact with thrombokinase which is present in the tissues and probably in the white cells and blood platelets, and thus its antithrombin is neutralized. Howell, whose work on these lines is classical, places the process in this wise: Blood is kept fluid by an inhibitory substance which acts upon the prothrombin. This inhibitory substance is neutralized by tissue extract (cephalin) furnished by the tissue cells or the blood platelets and the prothrombin is then activated by calcium to form thrombin. Thrombin acts upon the fibrinogen already present in the blood and forms fibrin which is the essential element of the clot.

The dose of hemostatic serum is 2 cc. to 5 cc. given hypodermically or in urgent cases intravenously, the dose being repeated every few hours until the oozing ceases. In the dose of 5 cc. or more it can be given by the stomach, although its action is necessarily delayed. It may also be applied locally on cotton when the oozing point can be reached. The hypodermic injection of agents designed to hurry coagulation is unwise unless it can be shown that coagulation-time is delayed. (See Ceanothyn, Calcium and Parathyroid Gland, Part II.)

HYPODERMOCLYSIS.

Hypodermoclysis is a method of supplying fluid to the body to replace that lost through excessive purging, as in cholera, in cases of hemorrhage and in all instances when the tissues are suffering from lack of fluid. Further, it may be used to wash from the body various impurities circulating in the blood and lymph, by flushing the kidneys. In other instances it may be used to supply the body with liquid when the stomach will not permit liquid to be swallowed, as in vomiting, or gastric ulcer or after abdominal operations. It consists in the introduction into the subcutaneous tissues of normal saline solution, which is rapidly absorbed by the vessels. As is well known, a quantity of liquid equal to four times that of the normal amount of blood may be passed directly into the veins without producing a rise of blood-pressure, and experiment has shown that usually within fifteen minutes after the fluid flows into the subcutaneous tissues an increased flow from the kidneys takes place. It is not safe to infuse a greater quantity of liquid than 1 dram to each pound of body weight in each fifteen minutes, as, if this amount is exceeded, the accumulation of the liquid in the system is so great that the tissues become drowned, because the kidneys cannot excrete the liquid fast enough. To carry out the operation, the sterilized liquid to be infused—the formula on page 638 is the best—is placed in a glass irrigator jar or rubber bag, which is absolutely aseptic. From the lower part of the vessel leads a rubber tube to which is attached a hollow needle also rendered sterile. The common practice of using a small cannula is painful and causes unnecessary trauma to the tissues. If the fluid is run in too fast it forms a hard swelling which is painful and may result in an ecchymosis and, if sepsis is present, even a slough. An ordinary No. 18-gauge needle is quite large enough and if need be by the use of a Y-tube two needles may be employed and the flow regulated, as in the Murphy drip (see Peritonitis). Such a needle will deliver about 50 cc. per hour and of course two needles will deliver 100 cc. A few drops of a 1 per cent procaine solution may precede the puncture to diminish the pain. The skin over the place where the liquid is to enter is to be rendered absolutely sterile, the needle is then inserted into the subcutaneous tissue of the thigh, or, preferably, of the abdomen, or below the breast, and the liquid allowed to flow at a rate named, the pressure being obtained by raising the container 2 feet above the belly-wall (Fig. 83). As the liquid enters, a swelling appears in the subcutaneous tissues, which soon disappears after the infusion ceases, and is much aided in its absorption by the use of very gentle rubbing or stroking.

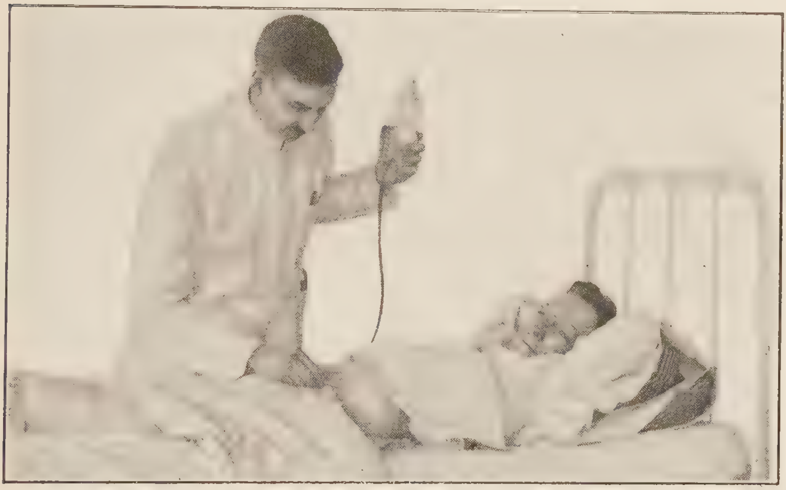

FIG. 83.—The apparatus and method used in giving hypodermoclysis. The ordinary irrigator is attached to a small needle, and this is placed in the loose tissue of the belly-wall or over the pectoral muscles.

When hypodermoclysis is employed after *hemorrhage,* the results are often extraordinary. It is of great value in the *collapse* of cholera. (See Cholera.) The cyanosis decreases rapidly, the pulse improves, and respiration is no longer difficult. Some physicians have used hypodermoclysis with very good results in the treatment of *uremia* due to chronic contracted kidney after venesection, thereby diluting the poisons and preventing them from acting so severely. In *septicemia, diabetic coma,* and similar states this method of treatment may be employed. When general dropsy is present, it is manifestly useless and harmful. Hypodermoclysis has also been used with great advantage in the treatment of *severe burns* to overcome shock and toxemia and supply fluid. This need of water in cases of burns is to be always remembered. The salts in the solution compensate for the loss of chlorides and as this loss is particularly characteristic in cases of *intestinal obstruction,* hypodermoclysis is useful in such patients not alone by providing fluid.

In cases of *surgical shock* warm saline fluid used by hypodermoclysis is often of great service. (See also Intravenous Injection; Transfusion.)

INHALATIONS.

The value of inhalations is not recognized sufficiently by the medical profession. As a matter of fact, they are capable of aiding very much in the treatment of disease and of producing results otherwise unobtainable. The employment of inhalations may be divided into the properly modified use of atmospheric air and the employment of atmospheric air charged with medicinal subtances. To carry on many of the forms of treatment which have been found of value requires cumbersome or costly apparatus which cannot be used except in institutions; but nevertheless the general practitioner can employ remedial measures by way of the respiratory organs with great advantage to his patients even when far removed from places where costly apparatus can be had.

The first form of inhalation to be studied is that which is devoted to proper respiratory exercises. These exercises are required by patients who because of faulty development do not properly expand certain portions of the chest in the function of respiration, and by those who have acquired impaired respiratory movements through the following of certain occupations or as the result of attacks of disease.

There can be no doubt that *pulmonary tuberculosis* may be prevented, or even arrested in its earliest stages, by causing a patient to use proper thoracic exercises, which must usually be directed toward producing expansion of the apices of the lungs, a part of these organs which in many instances is but poorly filled and equally ineffectively emptied under ordinary conditions of life. On the other hand, if the tuberculous process is active such exercises are usually unwise. The following inhalation exercises are to be directed for patients with poorly developed chests.

The patient stands with his back against a wall, holding himself as erect as possible and bringing his shoulder-blades flat against the plane behind him. He now takes a slow, deep, and full inspiration, drawing the air into the chest in a steady stream, and not by a sudden jerk of the respiratory muscles. The inspired air is to be held in the chest while the patient mentally counts three, and then allowed to escape gradually, and not forced out of the chest by sudden muscular effort. Usually four or five such movements night and morning are quite sufficient for good results for the first week. After that time they may be gradually increased in number.

Another movement may now be added to that just described. The patient, standing with his back against the wall and the shoulders well thrown back, raises his arms, which are completely extended from the sides until the hands are on a level with the shoulders, thereby fully expanding the sides of the chest. As expiration begins the arms are allowed to fall gradually to the sides. After this the arms may be carried above the head into a perpendicular position.

A third exercise consists in inhaling as deeply as possible and then exhaling against resistance produced by closing the lips and forcing the air between them.

The fourth exercise consists in lying upon a firm bed with a small pillow under the hollow of the back and no pillow under the head, and then taking slow, long-drawn inspirations and expirations as already described.

These exercises are useful not only in persons with faulty chest development, but also in those who have poor expansion of a lung some weeks after a pneumonia, pleurisy, or empyema.

The increase in the volume of air respired under gentle but persistently taken exercise of this character is quite remarkable and these movements often increase the appetite, the proportion of hemoglobin, and the general health of the patient.

In addition to these exercises there are others which, while not directly connected with breathing produce, nervertheless, deeper respirations and at the same time develop the chest muscles and cause the patient to hold himself erect, thereby preventing or correcting faulty pulmonary expansion. Nearly every physician can look back upon cases in which a slovenly carriage of the shoulders in early life has resulted in impaired chest expansion and finally in actual disease. The exercises to be ordered are shown in Figs. 84 to 91.

The next class of exercises consist in using simple forms of apparatus in association with respiratory movements. These are advantageous not only because they are beneficial in themselves, but also because they interest the patient and cause him to take exercises of which he might tire if they were performed without appliances.

The first of these consists in a pair of Wolff bottles joined together by a piece of rubber tubing (Fig. 92). The bottle nearest the patient is filled with water, and the patient, after taking a deep inspiration at the end of expiration, places a mouth-piece attached to a rubber tube between his lips and forces the water over from the first to the second bottle. This is usually sufficient for an exercise, and later in the day the patient drives the fluid from one bottle to the other a second time. Such a procedure causes the patient to take full inspirations and forcible, though gradual, expirations, with the result that he fully expands portions of the lungs hitherto but imperfectly inflated. It is therefore of value in patients with poorly developed chests, in cases after an attack of *pneumonia,* when complete resolution is long delayed, and in instances of deficient pulmonary expansion because of adhesions following an attack of *pleurisy.* In cases of *empyema* after drainage is established it is useful in that it aids drainage, keeps the

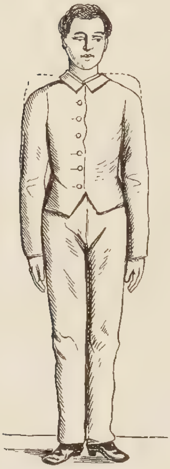
FIG. 84.—Standing erect.

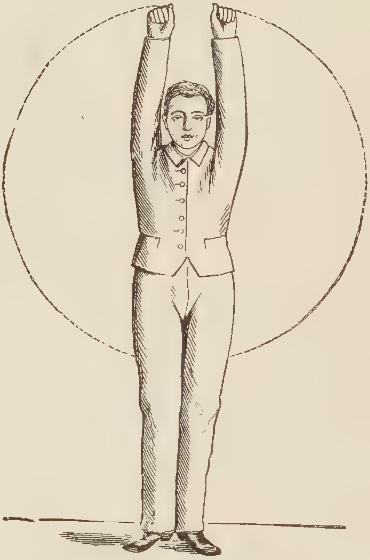
FIG. 85.—Stretch standing.

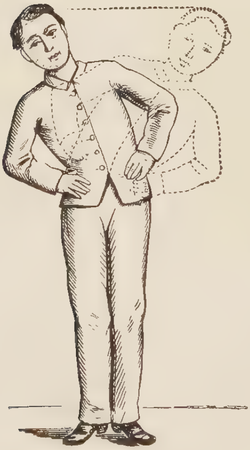
FIG. 86.—Wing standing, side bending.

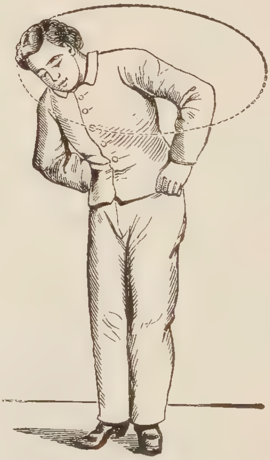
FIG. 87.—Wing standing, trunk rotation.

pleural cavity free from pus, and gradually causes the lung to descend once more into the lower part of the thorax. This practice is a very useful one in children, who may otherwise suffer from deformity due to collapse of one side of the chest if the lung is not properly expanded. It is not to be practiced immediately after the removal of a pleural

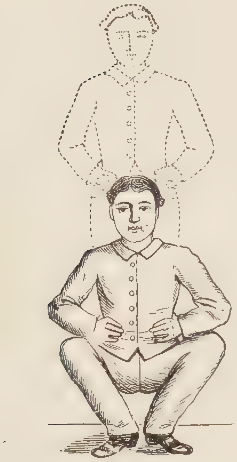

FIG. 88.—Wing standing, knee bending or curtseying.

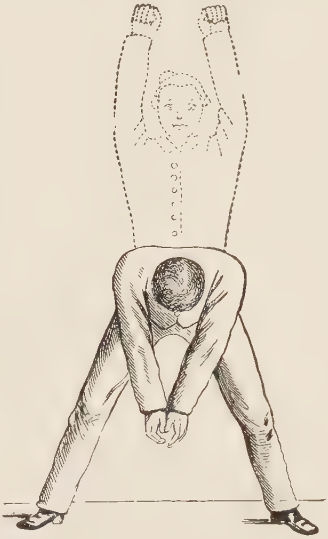

FIG. 89.—Astride, forward bending or hewing.

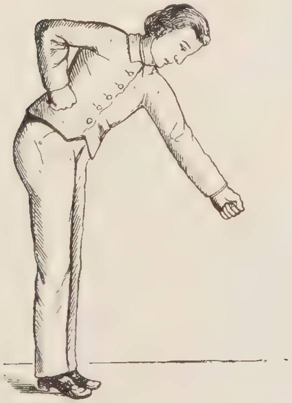

FIG. 90.—Half wing, half stretch, standing; forward bending or sawing.

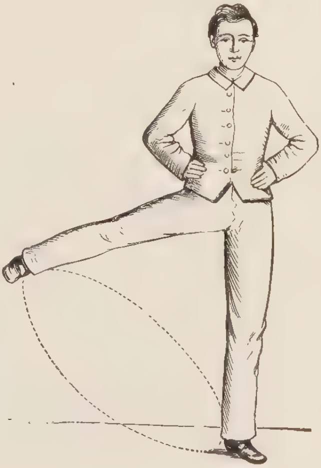

FIG. 91.—Wing standing, leg circling.

effusion or empyema, because time must be given the lung to expand naturally and adjust itself to the relief of pressure. It must be used with caution in pulmonary tuberculosis because forcible expiratory strain may induce pneumothorax.

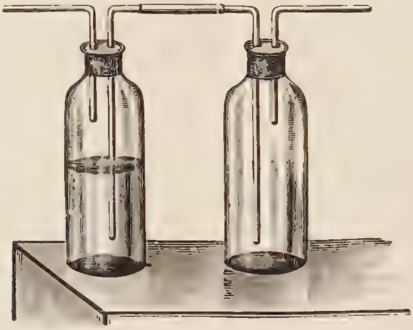

FIG. 92.—Arrangement of bottles for promoting lung expansion.

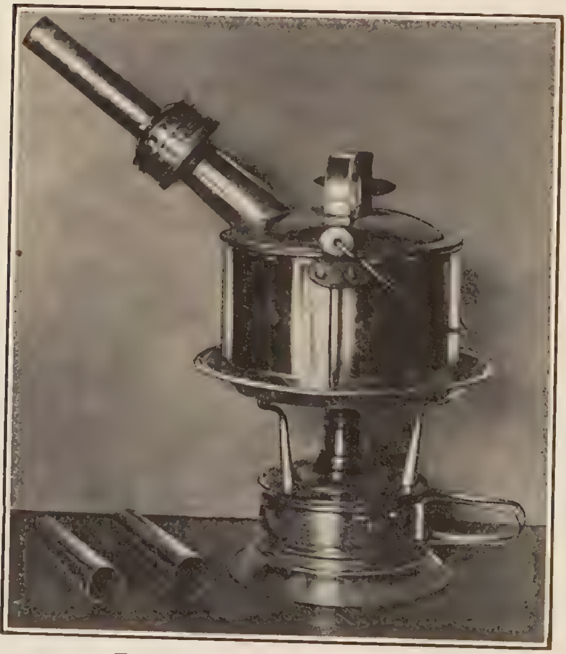

FIG. 93.—Croup kettle and inhaler.

We now pass to the consideration of inhalations designed to carry medicinal substances into the lungs for their effect on the respiratory tract or to influence the general system, not including, however, the use of general anesthetics. The air respired may be medicated by the following methods: (1) Setting free in the air of the room volatile substances derived from chemical or vegetable sources, using materials which are naturally volatile or which can be made so by the aid of dry or moist heat (2) The use of a mask or inhaler so arranged that a part at least of the inspired air must pass through or over a sponge or piece of cotton moistened with the medicament. (3) The nebulizing of substances which are not volatile by the use of compressed air.

In cases of *spasmodic croup* a few crystals of menthol placed in an iron spoon may be volatilised over a gas jet or alcohol lamp, and so diffuse the vapor through the air of the room. (See Menthol, Part II).

In other instances it is better to set free menthol, terebene, eucalyptol, or oil of pine by the aid of steam, allowing the steam to escape freely into the air of the room or to enter a "bronchitis tent." (See article on Bronchitis.) Five to 20 minims (0.3–1.3) of any of the substances just named may be added to the water when it is boiling. When menthol is used, place 2 to 5 grains (0.12–0.3) in the hot water at a time. The steam allays irritation by increasing the moisture in the air of the room, checks coughing, and aids the action of the drugs. Steam usually does badly, however, if there is an excess of secretion in the lungs. The drug to be used may be placed in the water in an ordinary teapot heated by a lamp, or gas jet, or the "croup kettle" may be employed (Fig. 93), or in its place the appliance shown in the article on Bronchitis.

The following formula is useful in many cases of *pulmonary tuberculosis* and *bronchitis* with a dry cough, if placed in such a steam inhaler:

℞—Olei pini sylvestris	f℥j (30.0)
Olei eucalypti	f℥j (30.0)
Creosoti	f℥ss (16.0).—M.

S.—Place 1 to 3 drams (4.0–12.0) in the water in the boiler and inhale the steam three or four times a day.

If there is excessive cough, ½ ounce (15.0) of spirit of chloroform may be added to the above prescription with advantage.

In many cases of *acute laryngitis* the following formula is of excellent service if used in this manner:

℞—Tincturæ benzoini compositi	f℥j (30.0)
Mentholis	gr. x (0.60)
Spiritus chloroformi	f℥ss (16.0).—M.

S.—Place 1 to 2 drams (4.0–8.0) in the water in the boiler, inhaling the steam from a freshly made watery mixture several times a day.

After using the steam inhalations the patient must not inhale for several hours the outdoor air if it is cold.

For use with the mask or face inhaler (Fig. 94) the following formula is valuable in cases of *chronic bronchitis* with excessive cough:

℞—Chloroformi	f℥ss (16.0)
Creosoti	f℥ss (16.0)
Mentholis	gr. x (0.6).—M.

S.—10 drops on the inhaler every three hours.

Any one of these ingredients may be used alone. Sometimes where it is desired to liquefy tenacious bronchial mucus 10 drops of iodide of ethyl may also be placed on the inhaler to act as a stimulant expectorant. The mask or Yeo inhaler must be used almost constantly if it is to produce good results.

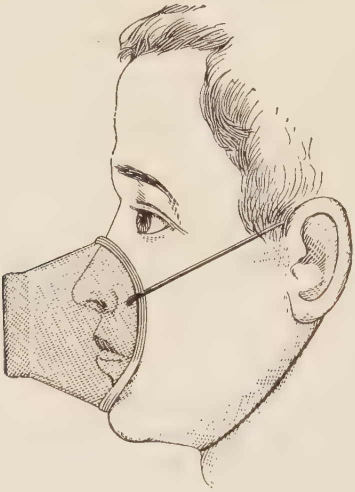

Fig. 94.—Yeo's inhaler, made of perforated zinc bound on the edges with chamois skin and supplied with elastic loops to go back of the ears or around the head. On a sponge placed in the front of the inhaler is dropped the medicine to be inhaled.

Small pocket inhalers containing medicated cotton may be used. A small glass tube is partly filled with cotton, and this is kept in place by perforated corks fixed in either end. Any of the medicaments named may be placed on this cotton, and the air inhaled through the tube. A tube of this sort packed with crystals of menthol, and called a "Menthol Inhaler," is largely sold at present. It is of value in *acute colds*. A useful modification of this straight tube is that of Evans (Fig. 95). In this apparatus the sponge in the bulb is wet with the medicament.

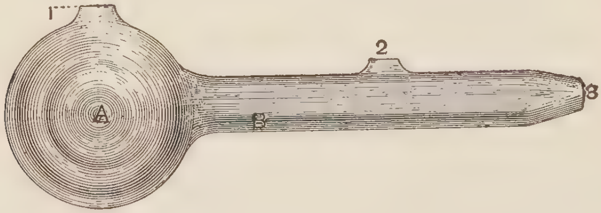

Fig. 95.—Evans's pocket inhaler. Half size. The finger of the patient may be placed over the opening marked *1* when exhaling, and over that marked *2* when inhaling.

There are on the market at the present time a large number of so-called vaporizers or nebulizers, which by the aid of compressed air force the medicament to be inhaled in a fine spray against the side of the glass containing it, in this manner still further comminuting it and causing it to escape from the bottle or bulb as an exceedingly fine vapor. The larger ones are supplied, as a rule, with compressed air from a force pump or large hand pump. The smaller ones are worked by a small hand pump or rubber bulb. The forms employed largely by the writer are the Oliver and the Glaseptic vaporizer. (See Fig. 96.) For a satisfactory use of these nebulizers the medicament had better be dissolved in an oily fluid. The following formula may be used in such apparatus in *coryza* or *acute inflammation of the upper respiratory tract:*

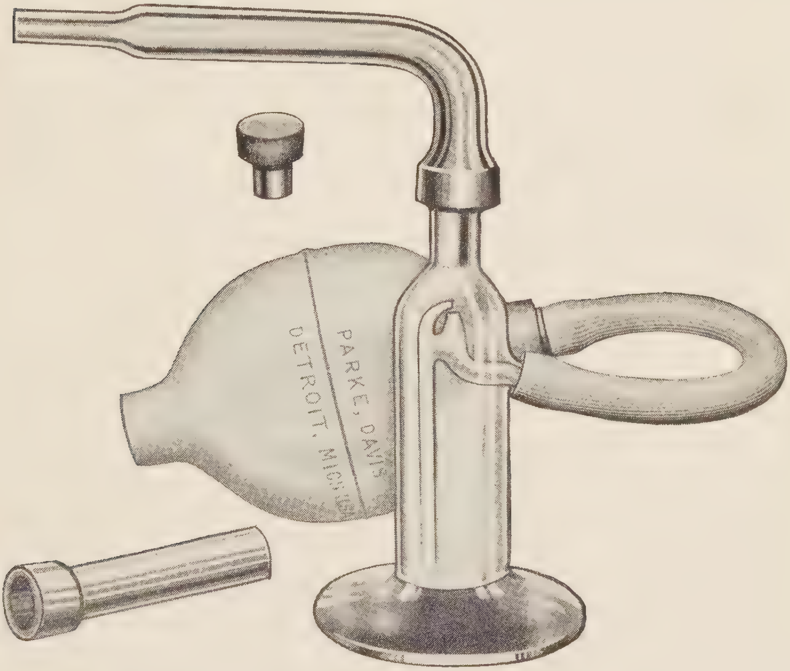

Fig. 96.—The Glaseptic nebulizer. All glass, ready for instant use, easily kept clean and equally efficient whether oily or watery spray is desired.

℞—Metholis	gr. xx (1.3)
Camphoræ	gr. x(0.6)
Alboleni (liquid)	f℥j (30.0).—M.

S.—Place in the nebulizer and inhale the vapor several times a day.

A somewhat similar formula of even greater value than this contains, in addition to the above, 2 to 5 grains (0.12–0.3) of chloretone, which is useful in that it is anesthetic and sedative to the mucous membranes. (See article on Peppermint.) Where the inflammation is very severe and acute, it is often well to substitute for the above formula the following one:

℞—Olei sassafras	gr. iij (0.2)
Olei santali	♏v (0.3)
Alboleni (liquid)	f℥j (30.0).—M.

Sig.—Use in vaporizer.

In such small amounts sandalwood oil is sedative. If we wish to use it as a stimulant expectorant, the quantity may be increased to 30 minims (2.0). An even more stimulant inhalation in cases of *chronic bronchitis* is as follows:

℞—Olei eucalypti	fʒj (4.0)
Olei picis liquidæ	fʒij (8.0)
Alboleni (liquid)	f℥j (30.0).—M.

S.—Use in nebulizer.

INTRA-ABDOMINAL INJECTION.

Intra-abdominal injections of normal saline solution may be practised with advantage in cases of great wasting and collapse arising from cholera infantum or cholera Asiatica. A fair-sized hollow needle is introduced into the peritoneal cavity just below the navel after the skin has been thoroughly sterilized. The solution should be at about 100° F. as it enters. From 100 to 250 cc. may be injected per day in the case of an infant. In older children or adults 300 to 500 cc. or more may be used per day. The fluid should not be used so freely as to distend the belly. Absorption is very rapid. This plan can be resorted to when hypodermoclysis, or the Murphy drip, are impracticable. At 4 per cent solution of dextrose may also be so given diluted with normal saline in the proportion of 1 to 4 as by this means pain is avoided. The dextrose may be sterilized in a test-tube and added to the fluid, but it is better to use the dextrose solutions now commonly marketed in sterile ampoules. Care should be taken that the fluid is clear. It has been shown that the use of properly prepared solutions do not cause peritoneal irritation. Citrated blood may also be given by this method in cases of severe hemorrhage, it having been proved that the corpuscles of the donor's blood are taken up from the abdominal cavity. Before injection the citrated blood should be strained through sterile gauze, and *the blood tests used before transfusion* should be utilized. Those who have resorted to this method of using citrated blood claim that it is much less apt to cause reaction than intravenous transfusion. (See Transfusion.)

INTRAVENOUS INJECTION.

SEE ALSO TRANSFUSION.

Many drugs are now given by this means of entrance into the body and normal saline or hypertonic saline is so used but as a rule intravenous injections should only be employed when no other method is adequate. When the solution employed contains a large amount of water it should be as nearly as possible isotonic with the blood, but if the bulk is very small and the injection is given slowly isotonicity is not essential, because the tonicity of the whole blood volume is not altered.

Where an intravenous injection is to be given to an adult a needle with a short bevel should be used, as by this means there is no danger of a long slender point wounding the posterior wall of the vein. The bevel edge should be up. One of the large veins at the elbow are usually employed. The skin is painted with tincture of iodine, a tourniquet placed about the arm, not tightly enough to interfere with arterial flow, and the patient told to close the fist. The needle, directed toward the body, is then slipped into the distended vein, and if it has entered the vein blood will at once appear. The charged syringe is then attached. The tourniquet is removed. The injection should always be given slowly so that not less than three to five minutes elapse. (For other venous entrances than the veins at the elbow see Transfusion.

The water used for intravenous injections should always be carefully prepared to avoid reactions. It is not alone to be sterilized and distilled but it should be buffered.

Various formulæ exist for the preparation of the so-called normal saline solution. Some persons are content to employ a solution of common salt in the strength of 1½ drams (0.7 per cent) to the quart in distilled or sterilized water, but this is a dangerous practice for the following reasons:

Very slight variations in the percentage of normal saline solution render it harmful. While the 0.7 to 0.9 may be considered permissible, a solution lower than 0.6 should not be used, because of the deleterious effects on the red blood cells and also because it will abstract salts from the tissues. If the solution is too strong it will cause the cells to part with their fluid.

It is evident, therefore, that an absolutely correct percentage is essential if salt solutions are to be employed. Many years ago Dr. Sydney Ringer, in London, found by accident, and proved by careful experiment, that a small quantity of calcium was essential to the satisfactory use of a sodium chloride solution. Later than this Loeb, Howell, Locke, and others have shown, with Ringer, that calcium and potassium are both essential, and Howell has concluded that the sodium maintains the proper osmotic relations between the cells and the fluid, that the calcium is a stimulating agent to the heart muscle, and that potassium is essential to its rhythmical contraction and relaxation.

Surgeons and physicians should not be content to employ salt solution prepared by haphazard methods. It is vitally important that these solutions shall be most accurately prepared, not only because they will fail to be of benefit if they are carelessly made, but also because the physician may do actual damage and impair his patient's chances of recovery if such care is not followed.

In addition to the effects which may be exercised upon the blood and its serum, it is interesting to note that Brown has shown that the use of pure sodium chloride solutions is not infrequently followed by glycosuria, whereas if calcium is added to the solution such a leakage of sugar does not take place. The old rule, therefore, that the normal salt solution may be made by adding 1 teaspoonful of common salt to 1 pint of water ought never to be followed if it can be avoided. Mathews also believes, and I heartily agree with him, that when large quantities of fluid are used in the peritoneal cavity, calcium and potassium should be present in addition to sodium chloride in normal quantities.

The best solution, because it at once supplants the blood which has been lost or is impure, and because it supports the heart, is:

Calcium chloride	0.25
Potassium chloride	0.1
Sodium chloride	9.0
Sterilized water	1000.0 cc

At the author's suggestion, these sterilized salts are now placed upon the market in hermetically sealed glass tubes. The contents of one of these vials added to 1 quart (1000 cc.) of warm pure doubly distilled sterile water make a normal saline fluid ready for instant use.

Recent researches have shown that many of the untoward effects which follow injection are due, not to the entrance of the fluid, but to the fact that the water, even if sterilized by boiling, contains the toxic products of bacteria or fungi which are primarily present in the water. The water should therefore be distilled as well as boiled and used as soon after distillation as possible, and when placed in the injection flask should be at 110° F., so as to be warm when it enters the vein. (See Fig. 98.)

The apparatus and technic used are as follows:

1. A sterile pitcher, in which is placed the hot salt solution with a sterile thermometer immersed in it so that temperature of 110° F. may be shown to be present.

2. A flask such as is used for giving arsphenamine. (See Fig. 98.)

3. Rubber tubing, at the distal end of which is a nozzle to fit in the needle used to enter the vein. In this rubber tube a segment of glass tubing or an infusion thermometer should be inserted in order that air globules may be discovered and the temperature of the flowing fluid watched. The tubing should, of course, be sterile and long enough to permit it to be coiled in (4) a basin of hot water so that the salt solution as it passes slowly through the tubing to the vein does not become chilled.

5. The skin over the vein, usually one of the arm, is sterilized by iodine tincture and washed off by alcohol.

6. The reservoir is now held so that the tube hangs perpendicularly and fluid is poured from the pitcher to displace air from the tube. When air-free a clip is placed on the distal end of the tube near the nozzle to hold the fluid in and keep the air out if the distal end of the tube is lifted.

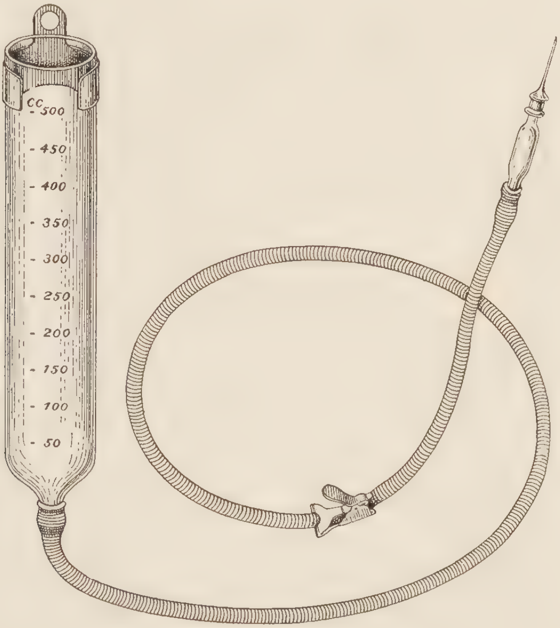

FIG. 97.—The reservoir, tube and needle of this apparatus may be used for intravenous injection.

7. The needle is now inserted in the vein and as soon as this is done the clip is released and, as the solution escapes, the nozzle is inserted in the shank of the needle.

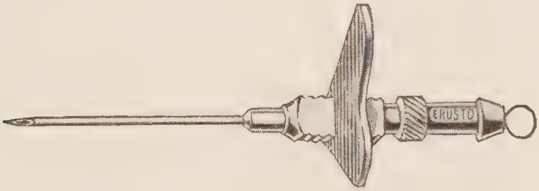

FIG. 98.—Needle for intravenous injection.

8. The reservoir is held about 1 foot above the arm and at least thirty minutes should be used in injecting as much as 1 quart.

9. If the arm is fat, or the vein collapsed, it may be necessary to incise the skin and expose the vessel.

In infants saline solution, or dextrose in 5 per cent solution (3 grains to each pound of patient), may be injected into the longitudinal sinus through the posterior portion of the fontanelle in the middle line. Four to 8 ounces (120.0 240.0) is usually enough. (See Dextrose, Part II, Transfusion and Intra-abdominal Injection.) If dextrose is used it is to be recalled that more than 0.8 gram to the kilo per hour will result in glycosuria.

An efficient home-made apparatus can be gotten together by taking a bottle of any considerable size, using a cork with two holes. Through one of them is placed a glass tube long enough to reach the bottom of the bottle and through the other hole is inserted a short tube reaching into the neck of the bottle. To the short piece is attached a piece of rubber tubing, to the distal end of which is attached a hollow needle. By means of adhesive strips running from the neck to the bottom of the bottle a sling is made, so that when the bottle is inverted for infusion it can be hung above the patient. When the bottle is inverted the air enters by the long tube and the solution escapes by the short one.

As the injection is given the pulse begins to improve, the respirations are deeper and less hurried, and if fever is present the temperature usually falls. The patient is evidently better, but may enter a critical stage, particularly if the water has not been properly prepared, which may come on in from two to thirty minutes. There are sometimes a violent chill, a strong, rapid pulse, and in the course of three-quarters of an hour a flushing of the skin, followed by profuse sweat. The respiration may be labored. The urinary flow is also increased, and sometimes water escapes from the bowel. These symptoms rarely occur if doubly distilled water is used. Several hours later the real benefit appears in convalescence or in marked improvement.

Something depends upon what the physician believes necessary in a given case. When there has been great loss of blood, or when it is desired to get immediate effects, the injection may be given in a relatively brief space of time as just indicated, but in many cases it is desirable to provide the body with fluid gradually over a long period of time, as, for example, when dehydration is present for various reasons. This is more nearly physiological than the injection of a pint in a brief space and if need be drugs which are perfectly soluble, or glucose or levulose may be added (see below). For such an injection the apparatus advised for the so-called Murphy drip may be employed (see Peritonitis, Part IV). If a small trocar and cannula is used to enter the vein whereby there is no sharp point, after the trocar is withdrawn, the cannula may remain in the vein indefinitely without hurting the intima. It is kept in place by a strip of adhesive plaster passed around the arm. I have found the Lindeman needles the best. The placing of an infusion thermometer in the circuit of the tubing is particularly necessary when using this method so that the nurse may see to it that the fluid slowly entering the vein at the rate of, say 60 drops a minute is at the lowest about 100° F.

It is important to bear in mind that a very low content of hemoglobin is compatible with life if only the bulk of the blood is restored.

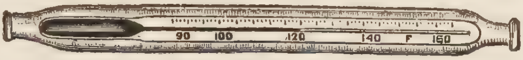

Fig. 99.—Infusion thermometer.

Saline injections may be given to compensate for acute hemorrhage, to diminish toxemia (see Diabetes), and to give the body fluid when it has been deprived of it by profuse vomiting and purging. (See Cholera.) Saline injections are also valuable when the body has been deprived of chlorides as in intestinal obstruction and patients suffering from severe burns in both of which states there is a great loss of salt from the blood stream. Unless the conditions are urgent hypodermoclysis or proctoclysis may be sufficient in such cases. (See Hypodermoclysis and article on Peritonitis.) The amount of saline given to an adult intravenously usually varies from a pint to a quart.

In some cases it is wise to add dextrose to the fluid injected, particularly if the urine contains acetone or diacetic acid, as, for example, when the patient has been starved by prolonged vomiting or other cause. From 100 cc. to 500 cc. of normal saline containing varying amounts of dextrose is the amount usually employed, bearing in mind that each gram of dextrose equal 4 Calories. For this purpose dextrose is now placed on the market in sterile sealed ampoules containing 10 grams (40 Calories) in 20 cc. of distilled water which has been buffered by sodium phosphate, and in ampoules holding 25 grams (100 Calories) in 50 cc. of water. When the larger ampoule is employed the contents of a small ampoule of 2 cc. containing sodium chloride and sodium phosphate, are added to the 50 cc. to properly buffer it to a hydrogen-ion concentration of 7 pH. Some practitioners dilute such solutions only twice or thrice and inject very slowly, since if given slowly the body has an opportunity to utilize or store the dextrose. If given so rapidly as to exceed 0.8 gram per kilo per hour the sugar is lost by the kidneys. (Wilder and Sansum.) Probably this loss is greatly increased if the renal threshold is low. (See Dextrose, Part II and Insulin, Part II.)

When diabetic coma (see Diabetes) exists the benefit is often only temporary unless dextrose and insulin are used. One unit of insulin is given hypodermically to each 3 or 4 grams of dextrose.

Investigation on the part of the author reveals the fact that frequently "glucose" is ordered for a patient without any specific statement as to its source or purity. Commercial glucose varies greatly in purity. Practically none of it is fit for intravenous injection. Use Dextrose.

In *uremia* and in *puerperal convulsions* the patient should be bled before, or simultaneously with, the injection, if the veins are turgid.

In the treatment of *Asiatic cholera* it has been found advantageous to use a salt solution of 1.0 per cent. (See Cholera, Part IV.)

If there is a tendency to pulmonary edema or general anasarca injections are contraindicated.

A saline solution is used intravenously by some persons to combat *shock*. Experience has shown that it is useless for this purpose because the dilated vascular system is not constricted by its use and a pint or quart of fluid does not increase the bulk of blood where it is needed, if at all, because the vessels relax still more and the fluid transudes into the tissues. (See Shock, Part IV.) Any temporary gain is due to the heat in the solution. This temporary effect on blood-pressure is shown in Fig. 100. Only whole blood from a proper donor does good (see Transfusion), or a saline solution of such hypertonicity that it takes fluid from the tissues, instead of pouring it out into them, is of any value. (For the use of sodium bicarbonate see Sodium Bicarbonate in Part II.)

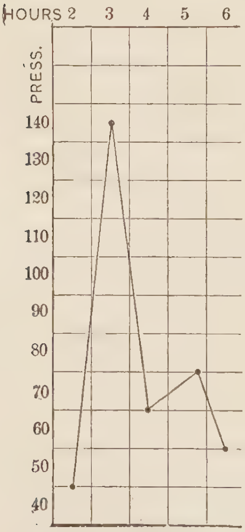

FIG. 100.—Temporary rise of blood-pressure from normal saline.

Hypertonic saline solutions (15 per cent) are now used to decrease intracranial pressure in cases of brain tumor and to decrease intracranial pressure after injury to the head or prior to cerebral surgery. They act by withdrawing liquid from the cerebrospinal system, in other words, a form of medicinal spinal puncture. Twenty cc. of a 30 per cent saline has also been so used for the relief of headache in inoperable brain tumor and in cases of deep coma, when there is reason to believe that high intracranial pressure is present. Such an injection may restore consciousness. Sometimes as much as 100 cc. are given but the injection should be so slow that not more than 3 cc. a minute enter the vein. Such an injection may also be used to decrease excessive intraocular pressure. It has also been found that when intestinal torpor, without mechanical block, as in postoperative ileus, exists this strong solution given into a vein will often cause active peristalsis and further that even when actual block exists great good results from hypertonic saline by thus providing water and sodium chloride in the body. The injection may be given every twelve hours or in urgent cases oftener than this. (See article on Cholera for hypertonic solutions.)

The intravenous injection of medicines is a method which is to be employed only under unusual circumstances, as, for example, arsphenamine in syphilis and quinine in severe malarial infection, although recently the use of many other drugs by this method has become fairly popular. (See Arsphenamine and Cinchona.)

When salts are so used those with a sodium base are always to be employed because potassium is a depressant. Drugs so given act in mass and at once as there is no delay as with gastric absorption, nor is there the possibility of entire failure of absorption. To meet emergencies and when it is desired to produce immediate and massive effects intravenous injections are without doubt useful if carefully given. In my opinion only those solutions already prepared and marketed in sterile ampoules should be employed to avoid infection or reaction from the use of water, which may not be perfectly pure as to germs or as to toxic agents arising from them or other sources. Such prepared solutions can, in most instances, be drawn up into a large syringe and injected without further dilution. Sodium iodide is one of the medicaments most commonly given in this manner.

The injection should be made very slowly under strict asepsis.

The intravenous injection of substances, in solution, which have been proved to act as antiseptic agents elsewhere than in the blood stream, has great attraction when it is believed that a bacteriemia is present. Up to date as many failures, or disasters, have followed their use as successes and when recovery has ensued it is a grave question whether it would not have occurred anyhow. The substances commonly used are mercurochrome-220, gentian violet and neutral acriflavine. The fundamental difficulty lies in the fact that up to date no drug has been discovered that will have a specific effect on such bacteria without destroying the normal cells of the patient's body, notably in the vascular system, and in the kidneys by which such drugs have to be eliminated. If these drugs are used too freely they may decrease the natural protective measures of the body, as, for example, by inhibiting phagocytosis. There is little or no evidence to show that any so-called antiseptic can be given by this means in safe dose and actually sterilize the blood stream. They remain in the blood stream for such a brief period that they have little time to act. Furthermore even if they do sterilize the blood they fail to pass into the infected tissues. Until we have developed bactericidal substances which have a specific affinity for each bacterium intravenous injections for bacteriemia is of questionable value. If intravascular antiseptics are used the object should be to cause bacteriostasis not bacteriolysis. Doses large enough to destroy myriads of germs set free masses of endotoxins. Indeed a very heavy blood stream infection as shown by cultures rather indicates small doses frequently repeated than an endeavor to sterilize the blood. If possible the use of the antiseptic should be guided by the culture plate and the polymorphonuclear count. (See Puerperal Diseases Part IV.)

It is needless to say that the solution of the drug which is injected into a vein should always be nearly neutral or slightly alkaline in reaction in order to avoid coagulation of the blood. In other words properly buffered, the water sterile and twice distilled.

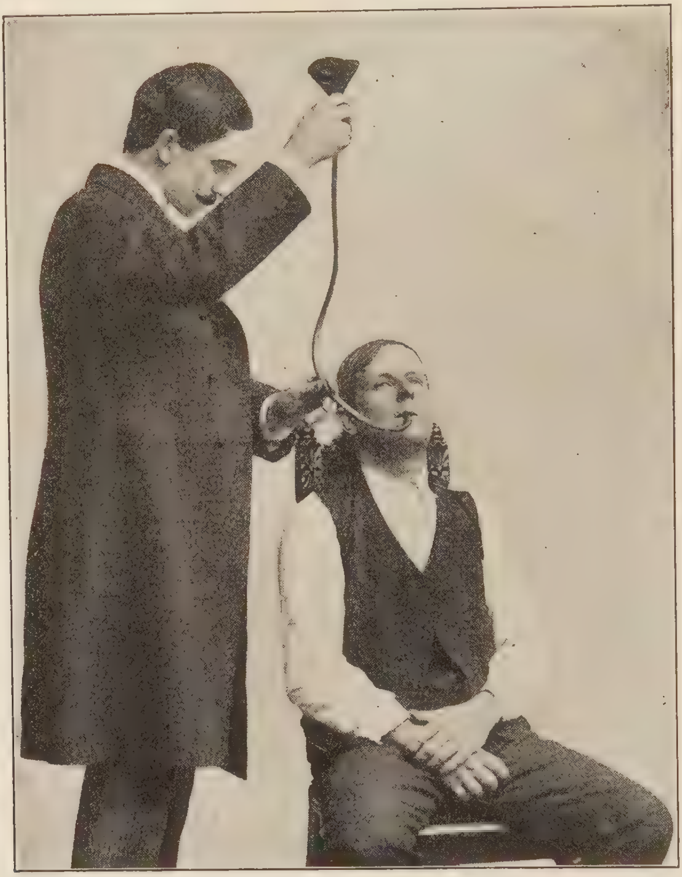

FIG. 101.—The stomach-tube having been passed, the funnel is filled from a pitcher and elevated to urge the water into the viscus.

LAVAGE.

This is a term applied to washing out of the stomach in cases of gastric dilatation, chronic gastritis, poisoning; and in obstinate vomiting. It is particularly valuable in the two first-named conditions not merely for its curative power, but also to rid the stomach of mucus and render it clean before fresh food is ingested. It is frequently employed prior to abdominal operations.

The liquid employed should always be warmed. For an adult a tube should be used of at least four and a half to five feet in length, of which eighteen inches pass into the mouth, the remaining portion reaching to the basin when lowered to allow siphonage. The question as to the variety of tube to be employed is a vital one, since a poorly devised apparatus not only gives no relief, but disgusts both the patient and the physician with the technic of the method. The tube should be more like a hollow bougie than a catheter, in order that its caliber may be great enough to carry off some of the semisolid materials present. If this rule is not followed, two evil results follow: In the first place, the tube and its apertures rapidly, or even at once, become clogged; secondly, the liquid is drained away leaving behind a mass which is semi-solid, to be sure, and less bulky, but which is nevertheless the quintessence of the nastiness of fermentation, and quite as qualified to contaminate any fresh food on its entrance as the liquid would be.

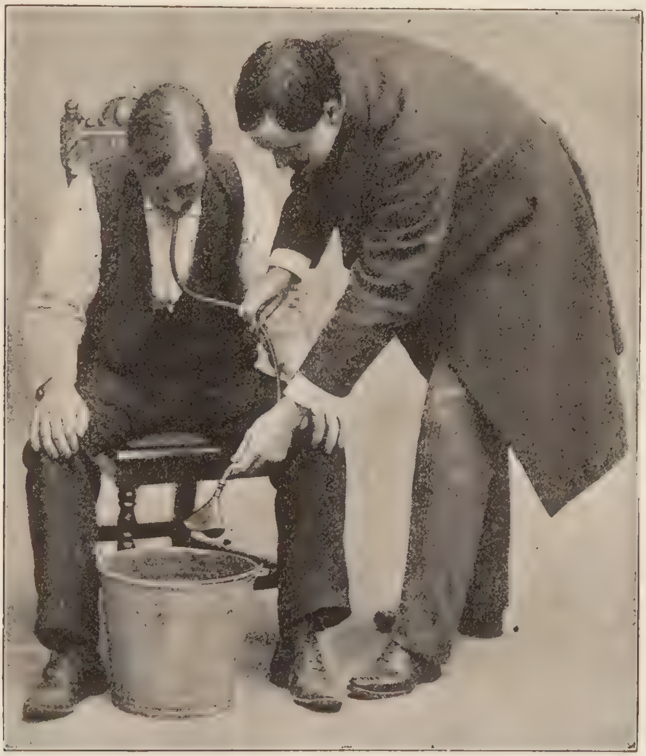

FIG. 102.—Just as the last portion of the water is about to disappear down the tube the funnel end is lowered and the contents of the stomach are siphoned out.

The holes in the gastric end of the tube should therefore be of sufficient size to take in fairly large masses. In most cases the ordinary siphon principle may be used, but where there is any solid food or resistance suction by means of a stomach-pump is necessary.

The best tube for adults in No. 20, made of red Para rubber with lateral holes.

The method by which lavage is employed as follows: The tube should be passed backward against the roof of the mouth, so that by following the curve of the hard and soft palates it is directed into the pharynx and esophagus, and then by gentle pressure forced into the stomach. At the same time the patient should be directed to swallow. The mucus in the throat sufficiently lubricates the tube, and oil is not to be used. If gagging is excessive, the pharynx may be first lightly sprayed with a 2 to 4 per cent solution of cocaine. The irritability of the pharynx usually rapidly disappears, and it is surprising how quickly the patient becomes accustomed to the operation, and submits to it without any feeling of discomfort. After the tube has reached the stomach a small funnel is to be fitted in its external end, which is then held above the head of the patient while water is poured into it until the stomach is filled, when the funnel end is lowered and the stomach is emptied by syphonage.

The routine use of lavage before operation upon the abdominal area is unwise because it causes retching and irritates the vomiting center if the patient is not accustomed to its use. Whatever its advantages may be as to the stomach it strains the circulatory system and shocks the nervous system. In cases in which it is known that the stomach is loaded with food and drink it is essential.

It is particularly necessary in children, if a catheter is used and on account of the lack of intelligent aid and their liability to gulp, that every care should be taken that the tube does not slip entirely out of reach into the stomach; and for the prevention of this danger a string should be attached to the external end of the catheter before it is introduced, and the tube should always be at least 30 inches in length.

In cases in which it is difficult to pass an ordinary stomach tube because of retching, the difficulty can be escaped by the application of a 4 per cent solution of cocaine with a 1 to 10,000 solution of adrenalin to one nasal chamber by means of a pledget of cotton. By this means the tissues are shrunken sufficiently to make it possible to pass a Rehfuss duodenal tube, or a catheter, through the nose and pharynx. If the pharynx is very irritable, it can be cocainized before the Rehfuss tube is passed. Needless to say the tube should be lubricated. As the tube gets well into the pharynx the patient may drink water so as to aid in carrying the tube into the stomach. To the outer end of the tube is now attached a large syringe, and the gastric contents are removed by suction instead of relying upon syphonage, as in the method above described. This method of using a tube has the advantage that after the stomach is washed out, the tube can be left in place for many hours for subsequent washings, and, if desired, food may be introduced through it not only into the stomach but into the duodenum. (See Gavage.)

After operations this method will often prevent gastric dilatation and if the tube is left in place and a longer piece of tubing is attached so as to reach a bottle on the floor constant drainage of the stomach can go on by syphonage. The tube is kept in place by an adhesive strip on the cheek and another on the edge of the bed or mattress. This arrangement permits the patient to ingest water, if it is desired by the medical attendant.

LEECHING.

Leeching is a method of abstracting blood for the purpose of relieving local inflammations or acute congestions. There are two forms of leech commonly employed in medicine, both of which are imported. A small leech is found in many streams in the United States. Leeches, after attaching themselves to the skin by means of their sucking apparatus and teeth, secrete a liquid which prevents coagulation of blood, and this accounts for the persistent hemorrhage sometimes seen after a leech-bite.

Therapeutics.—The reasons for using venesection or depletion are considered farther on, and we can therefore pass directly to the uses to which leeches are put. In cases of *meningitis* they may be applied to the temples or to the nape of the neck, and they are useful in the treatment of *swollen joints*, such as occur after *sprains*. In *orchitis* they should not be placed upon the scrotum, but on the groin. In *conjunctivitis* or inflammation of the eye they should be applied upon the temple or back of the ears, not upon the lid itself. The effect of leeching is not only that of depletion, but also one of counterirritation.

Fig. 103.—Showing the application of leeches in front of and behind the ear, for the relief of the early stages of acute otitis. The auditory meatus is plugged with cotton to prevent the leech from entering the canal by accident.

Application.—Leeches if singly applied may be placed on the skin under an inverted wineglass or under a large pill-box to prevent them from migrating before they take hold. If they will not take hold, a little sweetened milk may be placed on the skin or a drop of blood extracted from the finger may be placed there. In all cases the skin should be carefully washed before the leech is used. When the leech has taken enough blood, it can be made to let go its hold by sprinkling it with salt. Each leech will take about 1 dram of blood. Leech-bites should be watched lest prolonged consecutive bleeding exhaust the patient. In case of such an accident, a compress and styptics are to be employed. As leech-bites make small permanent scars, the leech should not be applied on the face or other exposed surface of the skin.

Richaud's table indicating the areas of the skin to which leeches or cups are to be applied to directly affect the viscera by abstraction of blood.

AREAS TO BE DEPLETED.	AREAS TO WHICH DEPLETION IS TO BE APPLIED.	PATHS OF COMMUNICATION THROUGH WHICH DEPLETION TAKES PLACE.
Appendix.	Groin.	Spermatic veins, circumflex, iliac, and ileolumbar veins.
Liver.	Anus.	Portal vein, anal and perineal vessels, hemorrhoidal veins.
Uterus.	Anus.	Uterine and hemorrhoidal veins.
Bladder and prostate.	Anus.	Prostatic and hemorrhoidal veins.
Testicle.	Groin.	Spermatic and inguinal veins.
Pericardium.	Third, fourth, and fifth left intercostal spaces.	Pericardial and internal mammary veins.
Lung.	Third right intercostal space between the vertebral column and shoulder-blade.	Bronchial and azygos veins and superior intercostal veins.
Eye.	Mastoid apophysis.	Ophthalmic vein, cavernous sinus, petrous and lateral sinus.
Tonsil.	Angle of the jaw.	

LUMBAR AND CISTERNAL PUNCTURE.

Lumbar puncture consists in the introduction of a fine bevelled cannula with a trocar between the third and fourth or fourth and fifth lumbar vertebræ. The operation can be performed when the patient is sitting up, with the spine bent by bending forward (see Procaine), but is best done, particularly in children, with the patient lying on the side with the neck, knees and hips sharply flexed so as to separate the vertebræ. This sharp flexion is essential particularly for a novice. The easiest way to find the level at which the puncture is to be made is to draw a line across from the crest of one ilium to the crest of the other, which line runs between the third and fourth lumbar vertebræ. In children in whom the vertebral spines are not well developed the best point for inserting the needle is the middle line, but in adults in whom these spines are developed and whose vertebral bodies are better separated a point about $\frac{1}{8}$ to $\frac{1}{4}$ inch below the middle line, the patient being on his side, is the place of election. The direction of the needle should be slightly upward and forward to a distance of about 2 centimeters ($\frac{3}{4}$ inch) in children and 4 to 6 ($1\frac{1}{2}$ to 2 inches) in adults. As soon as the subarachnoid space is reached on the withdrawal of the trocar the cerebrospinal fluid will flow freely or even spurt out if the intraspinal pressure is abnormally high. A dry tap may be due to (*a*) failure to enter the subarachnoid space, (*b*) to going too far and fetching up on the bone on the far side, (*c*) to a minute piece of bone, cartilage or other tissue, plugging the end of the cannula as the trocar is introduced. It may rarely occur from a fragment of lymph when the fluid is purulent or to adhesions as the result of an acute inflammation. The first cause of failure is to be relieved by pushing the cannula further in. The second by withdrawing slightly. The third by rotating the trocar in the cannula or rotating the cannula. If these measures fail make another puncture between the second and third lumbar vertebræ. If the pulse becomes rapid and the blood-pressure falls as the fluid is withdrawn the tapping must cease at once. If a young child is tapped a bulging fontanelle becomes flattened. As soon as a tendency to concavity of the fontanelle is produced the operation must cease. After a spinal puncture the patient should be kept in the dorsal decubitus for some hours, and even if this is done he may have severe headache. Absolute surgical asepsis is, of course, essential. When the pressure is normal the fluid will flow from the needle at the rate of 30 to 40 drops per minute. When the pressure is high it may run in a stream after first spurting. If possible it is best to accurately measure the pressure by a manometer. In adults when lying on the side it will be found equal to 5 or 10 millimeters of mercury or about 130 millimeters of water. In children it is 0 to 4 of mercury, 45 to 90 of water but it is to be remembered that crying and struggling will greatly raise the pressure.

Therapeutics.—Spinal puncture is resorted to for three purposes—namely, treatment, diagnosis, and spinal anesthesia. (See Procaine.) For treatment it is indicated chiefly in the convulsive seizures of children and in adults with uremia. It is useful in all cases in which the symptoms indicates increased cerebrospinal pressure and in fracture of the skull when the tapped fluid may be found to be bloody. If convulsive seizures are recurrent, spinal puncture by giving relief to cerebrospinal pressure will arrest these in a fair proportion of cases. Usually about 15 to 20 cc. are withdrawn in adults, but as much as 40 cc. or even 60 cc. may be taken away. If the fluid is turbid it is a sign of infection of the meninges, most commonly by the meningococcus or by the pneumococcus, and if the infection is severe it may be not only turbid but yellowish or greenish. The sugar normally found present by the copper test is absent and a large number of polymorphonuclear cells are seen under the microscope. So, too, there will be found a marked increase in globulin. The diagnosis is confirmed by finding a specific organism. When the tubercle bacillus is the cause of meningitis the fluid is clear, there is an excess of small mononuclear lymphocytes, and there is not a loss of sugar to so great a degree or an increase in globulin. When the diplococcus of Weichselbaum is found, 30 cc. of the cerebrospinal fluid is drawn off and substituted by the same amount of antimeningitis serum (see Antimeningococcic Serum, Part III) daily until the fluid is clear and the patient convalescent.

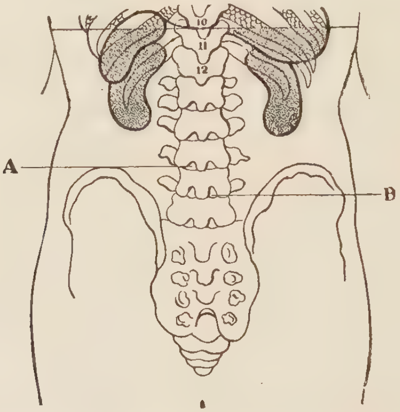

Fig. 104.—*A*, space between the third and fourth lumbar vertebræ for subarachnoidean injection (Quincke's area); *B*, area of puncture suggested by Tuffier.

When cisternal puncture is to be done the patient is placed on his or her side in the lateral posture as is resorted to oftentimes when doing lumbar puncture. The head is supported by a pillow so that the cervical vertebræ are in line with the dorsal vertebræ and then the head is flexed forward, chin down. A finger of the left hand finds the spine of the axis and an No. 18 gauge, bevelled, and fairly strong, needle is then pushed through the skin of the neck and along a line drawn between the external auditory canal and the glabella. The needle may touch the lower edge of the occiput but normally the first resistance after the skin is that produced by the dura mater, usually in the adult at the depth of 4 to 5 centimeters. It is well to mark the needle at the depth decided upon before introducing it, for if it goes too far it will damage the medulla oblongata which in the adult lies only 2 to 3 centimeters beyond the dura.

Cisternal puncture is performed for the purpose of relieving intracranial pressure, for the injection of antimeningococcic serum, or antitetanic serum, and to obtain cerebrospinal fluid for diagnostic purposes. If the fluid is under great pressure, drain slowly to the extent of 30 to 40 cc. and replace slowly with same amount of serum. If the fluid is purulent, Ringer's salt solution may be introduced through the cisternal puncture and removed by a spinal puncture, that is through and through drainage, or the cistern may be washed out by the same liquid.

MINERAL SPRINGS AND CLIMATE.

This article is intended to give the practitioner and student a general idea of where to send patients who can afford to resort to treatment depending upon watering places and climates. It is manifestly impossible to include the names of all the health resorts, and the object is to indicate the diseases which are benefited by these treatments, taking certain well-known resorts as types of each class.

Springs.

Medicinal springs are usually resorted to for the double purpose of drinking and bathing in the waters, although in many instances one of these methods so far exceeds the other in popularity that it alone is employed.

For general purposes we may divide these medicinal or beneficial waters into four classes—namely, those which act, first, by their purity, chiefly; second, by the presence of more or less active alkaline ingredients; third, by the heat which the waters contain as they leave the earth; and fourth, by the sulphur or radio-active substances which they contain. The first class—namely, those which act by reason of their purity—are indicated chiefly in cases where through high living or other cause the system becomes laden with impurities through imperfect elimination of tissue-waste. Most of the popular *lithia waters* depend chiefly upon this ability to dissolve effete materials, and very little upon the lithia, which is often present in very small amount. (See Lithium.) Aside from their purity, they also act by reason of the salts of sodium and calcium which they contain. Good results follow their use in the so-called *uric-acid diathesis* where the urine is scanty, high-colored and acid. They do good in cases of irritable bladder by washing out this viscus with mild urine in large quantities, and because of this influence are credited with wonderful cures of vesical calculus. When vesical calculi have broken down while these waters were being taken, the fortunate result has been coincidence rather than due to medicinal interference. It is impossible for them to dissolve stones, but their constant use may prevent the formation of new ones. Perhaps the best representative of pure natural waters is Poland water, from Poland Spring, Maine.

A subdivision of this class consists of those waters which contain somewhat larger amounts of mineral substances, chiefly potassium, sodium, and calcium salts. Because of the power possessed by alkaline salts in aiding diuresis these waters are used in cases where the kidneys, and perhaps the liver, seem torpid. Such springs are the Kissingen and Vichy at Saratoga. If very mild purgative properties are also desired, the Geyser Spring at Saratoga may be used. In

Europe the most famous springs of this class are at Vichy (Grande Grille), Vals, and Contrexeville in France, and Kissingen in Bavaria.

The second class of springs are those which contain salts of sodium, calcium, potassium, and magnesium in sufficient amount to possess very active diuretic and purgative properties. They find their therapeutic application in cases of hepatic torpor or congestion associated with gouty or rheumatic tendencies, particularly in those individuals who have been high-livers, who lay on too much fat, so clogging their organs, and, finally, in those who through illness or exposure to hot climates have subacute or chronic atony of the liver, of the organs of digestion, and of the lymphatics. Nearly always these patients also suffer from more or less constipation and gastro-intestinal catarrh, and are often obese. The sulphate of sodium is an ingredient of many purgative mineral waters, and the activity of a water depends very often on the percentage of this salt which is present. The purgative action of a water also depends upon the time at which it is taken. When taken on an empty stomach it is of course more active. When taken early in the morning before eating and at the natural temperature, such a water produces a loose watery movement, not only unloading the bowel of fecal matter, but by its alkalinity loosening catarrhal secretions and unloading the liver of congestion. The quantity to be taken in twenty-four hours varies from 1 to 4 pints, but this question can only be decided by the local physician, who studies the effect of the water on the patient. The best-known waters of this class are the Champion, Congress, Hathorn, and Carlsbad Springs at Saratoga, New York, the Crab Orchard in Kentucky, and the springs of Carlsbad and Marienbad in Bohemia, and Friederichshall in Germany. These waters are chiefly used at the site of the springs, except Hathorn and Friederichshall which are bottled and used in this country. Of the sulphate purgative waters the best known are Hunyadi and Apenta from Hungary, and Pluto of Indiana. These are bottled for transportation and widely used.

The *hot springs* depend chiefly on their heat, as already stated, and differ in chemical composition. They find their value in the treatment of *chronic skin diseases*, specific or otherwise, and also are useful in aiding in the treatment of *rheumatism*, *gout*, and *syphilis*. Their good results are produced by their heat, which varies from 93° to 150° F., and the advantages always derived from properly employed hydrotherapeutic measures. It is in chronic or subacute cases that they do the most good. Hot baths are also of great value in the treatment of *chancroid* and *malignant syphilis*. The results achieved depend upon the increased activity of the skin, the improvement of the peripheral circulation, and the increased powers of absorption of mercury produced through increased cellular activity.

Patients should always select a competent local physician at such resorts.

In cases of syphilis the methods of treatment to be followed are as follows: The patient should take the bath at a temperature of 98° F., and remain in it for about twenty minutes. After this he is rapidly but thoroughly dried by an attendant, who at once proceeds to rub into the skin of one thigh an amount of mercurial ointment varying from a few grains to a dram. This is well rubbed into, not smeared over, the skin of a different limb after each bath. The number of baths and inunctions depends upon the condition and necessities of the case, care being exercised not to push the mercury too freely in those who are very susceptible to its effect. These baths also aid in the absorption of mercury when it is administered by fumigation. The most celebrated of these springs are the Hot Springs of Arkansas and those found at Aix-la-Chapelle (Aachen) in Germany.

As types of the fourth class of springs we have the White Sulphur Springs in West Virginia and the Richfield Springs in New York, which are used for the relief of catarrhal inflammations of the mucous membranes of the alimentary canal and respiratory passages, and more rarely for catarrhal states of the genito-urinary tract. Not only do they exert the peculiar remedial powers long known to belong to sulphur and its compounds by reason of the sulphuretted hydrogen gas contained in them, but they also possess distinct purgative effects. Their chief mineral constituents consist of sulphate of sodium and magnesium, which unload the bowels and portal system in the same manner as do the Champion, Congress, Hathorn, and Carlsbad Springs at Saratoga and those at Crab Orchard. Taking the White Sulphur as a type of its class, it is better than the Saratoga springs in catarrhal states for the reason given.

Climates.

The practitioner is very frequently consulted as to the possible benefit of climatic changes by persons suffering from *pulmonary* disease, such as *tuberculosis of the lungs, asthma, chronic bronchitis,* and *emphysema*—more rarely by those convalescing from *pneumonia* or other severe acute illness.

The general rules to be followed in all cases are—first, choose a climate having as large a number of clear days as possible, in order that an out-of-door life in the sunshine may be had constantly; secondly, the nearest place to the home which is available in order to avoid fatigue, expense, and homesickness; and thirdly, see that the resort chosen has comfortable accommodations, good food, good drug supplies, and a capable physician at hand in case of need.

In a case of tuberculosis and in all patients suffering from the pulmonary complaints named above the following rules may be adhered to, except in persons suffering from attacks of acute bronchitis, who always need a climate providing moisture and warmth.

Some tubercular patients do best in a high, dry air, and others in a lower and more moist temperature—the first being represented by that of Colorado Springs (6000 feet) or Silver City in America

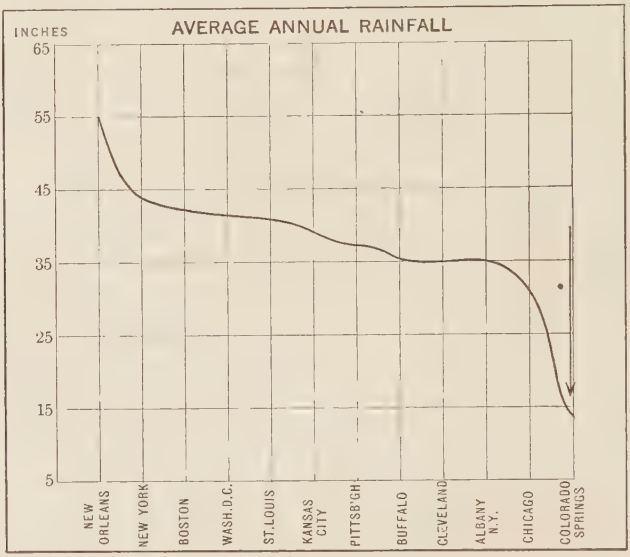

Fig. 105.—Chart showing comparatively little rainfall in Colorado Springs, Colorado.

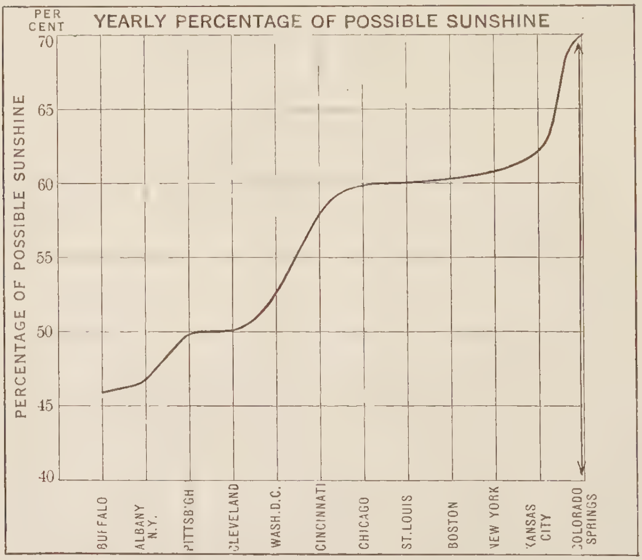

Fig. 106.—Chart showing relatively great number of hours of sunshine in Colorado Springs, Colorado. (Charts prepared by the Department of Physics, Colorado College.)

and by San Moritz (6000 feet) and Davos Platz (5000 feet) in Switzerland, where the altitude is not only very great, but the air very cold in winter. These places have many hours of sunshine and little rain. (See Figs. 105 and 106.) The second climate is represented by that of Florida and Southern California.

In those cases in which a mild climate is useful, this can be obtained at San Diego, a place where there is virtually perpetual summer. At Thomasville, Georgia (330 feet), the air is moderately dry. A spot is desirable where a patient can remain the year round, and, if well enough, engage in business, avoiding cold, sharp March winds of the Middle, Eastern, or Northwestern States, and the necessity of leaving Florida on the advent of summer.

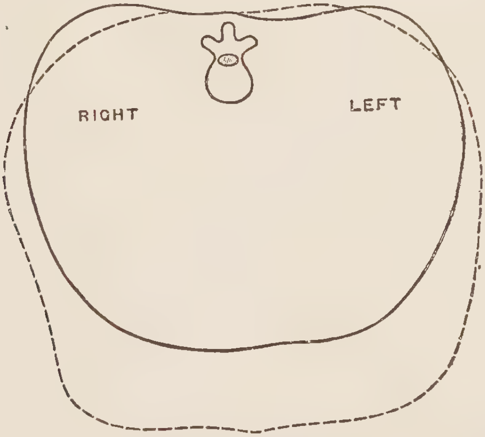

Fig. 107.—Chest outline before residence at Davos — solid. After residence at Davos ----. (William's diagram.)

Physicians have attempted for years to formulate rules for phthisical patients as to the climate to be sought. In very many cases the various health resorts have to be chosen by experiment, not by judgment beforehand. In cases of phthisis with profuse bronchial secretion, a high, dry climate is generally the better unless the heart is feeble, but in cases which suffer from dryness of the air-passages a sea-voyage or a warm, moist climate is better, on general principles. It is probably true, however, that high altitudes and rarefied air are not to be sought where a distinct tendency to hemorrhage is present, unless the ascent or removal to the rarefied air is very gradual, several weeks being passed before the lung is exposed to the low pressure of great heights. The cases in which high altitudes do good are those which naturally have poor thoracic development or suffer from chronic pleurisy with deficient expansion of the lung after tapping. A high altitude not only improves respiratory capacity and develops the chest, but also increases the richness of the blood in its red cells as to number and as to their content of hemoglobin. The following excellent advice given by White in his *General Therapeutics* is worthy of repetition:

"It is of such importance that only suitable cases should be sent to high altitudes that we must point out those that are unsuitable:

"1. Those in whom there is considerable affection of the bronchial tubes, for the dryness of the climate increases the kind of bronchitis which commonly accompanies phthisis.

"2. Patients with much emphysema or bronchiectasis, because of the probably diminished absorption of oxygen and the difficulty of respiration experienced on first arriving.

"3. Patients with disease of the heart must not go to a high altitude, because of its effect upon the pulse and upon respiration.

"4. Cases liable to acute febrile attacks, whether or not these indicate an occasional increase of mischief in the lungs, should remain on a low level.

"5. Patients who are very excitable or suffer from insomnia should not go, for a visit to a place at a great elevation promotes these symptoms. Women do not acclimatize so well as men.

"6. Cases in which there are very extensive lesions, or which are very advanced, are unsuitable.

"7. Pneumonic phthisis, if at all acute, is made worse by a high altitude.

"8. Patients who cannot take exercise should not go.

"9. The very old and the very young had better be treated at home.

"10. Sir Andrew Clark states that patients who go to Alpine health resorts suffering from albuminuria, or those who develop it whilst there, seldom derive any good from their change.

"There are many conditions which have been thought to contraindicate this treatment, but which do not, and they had therefore better be mentioned. They are:

"PULMONARY HEMORRHAGE.—It is now known that this, so far from being a contraindication to treatment by high altitudes, is actually relieved by it. The exact explanation cannot be given."

With this the author of this work cannot agree.

"FEVER.—If this is not excessive, and if it does not indicate any active changes in the lungs, it is often improved.

"SIMPLE DIARRHEA AND SIMPLE DYSPEPSIA.—These are both benefited.

"NIGHT-SWEATS.—There is a common belief that these forbid this treatment; on the contrary, they often disappear on removal to a high altitude.

"THE PRESENCE OF CAVITIES.—This is not a contraindication unless a very large area of lung is destroyed."

There is no need, after these two lists, to say what cases are suitable for climatic treatment: it may, however, be observed that those in whom there is threatened tuberculosis, with a strong hereditary predisposition, and those of imperfect thoracic development, are much benefited.

To these rules the author would add the following invariable rule, viz.: Do not send a case away to die. If the disease is so far advanced that no good can be derived from a trip abroad, it is cruel to make a wretched patient exhaust his strength, his money, and his happiness by seeking health which it is impossible for him to obtain. A patient of the writer's returned on one occasion from a stay of a few days at a noted Southern resort for consumptives, and, when reprimanded for his imprudence, replied: "I would rather be at home, and die at once, than drag out a few more years surrounded by a crowd of coughing, hawking, and wasting consumptives." The reply evidences clearly the necessity of avoiding "consumptive hotels" as much as possible in these cases, and of directing the mind of the patient from depressing thoughts and his own ailment, and that he may avoid secondary infection from other sufferers.

In the treatment of *renal* and *cardiac disease* high altitudes are contraindicated, as a rule. The chief desideratum is out-of-door life with avoidance of chilling of the skin by sudden changes in temperature or strong winds. San Diego and many other places in Southern California represent the necessary climate in such cases.

There is a class of persons who often have no actual disease of a chronic type, who nevertheless pass healthier lives if away from rigorous climates for at least part of the year. Without having acquired tuberculosis, their lungs are delicate naturally or because of attacks of disease, or, again, they become asthmatic or rheumatic in cold weather. In this country, Pinehurst and Thomasville, Ga., or San Diego or Santa Barbara, California, afford the climate desired, while in Europe patients are sent to what is known as the "Riviera," which is the district bordering on the Mediterranean Sea from Genoa to Nice and which is dotted with climatic resorts. This district has often as many as two hundred clear days between October 1st and May 1st. In the French Riviera the resorts are Cannes, Nice, Monaco, Monte Carlo, and Mentone; in the Italian Riviera, Bordighera and San Remo. In Naples and Spezzia the climate is more damp and colder, but nevertheless quite sunny. So much depends upon the location of the hotels in these places, as far as their salubrity in relation to air and dampness is concerned, that the patient should always consult a local physician before settling down permanently at any of these resorts.

POLLEN EXTRACTS.

It seems to be pretty well determined that the multiple symptoms covered by the general term "hay fever" are due to the entrance into the respiratory tract of substances which are derived from the pollens of the flowers and various grasses, shrubs and trees. In other words, such patients are sensitized to these substances and react to them as does a patient who has been sensitized by the injection of protein substances derived from blood serum.

Acting upon these basic facts the attempt has been made to protect so-called hay-fever patients by prophylactic injections of, and to treat the disease when already in existence by derivatives of, various forms of pollen. The two pollens which most commonly induce hay fever are timothy pollen in the spring and ragweed pollen in the early autumn, although it is possible for a patient to suffer from timothy hay fever late in the season and ragweed hay fever earlier than the usual time in August or a combination of both.

It is essential to determine which pollen is responsible for the symptoms. This may be done by carefully cleansing the skin of the forearm and drying it by evaporation. Then lightly scratch the skin over several small areas with a needle and rub in a specific pollen extract prepared for this purpose at each spot. If the patient is susceptible to a particular pollen, after five or ten minutes a colorless wheal appears surrounded by a reddish zone or areola and persists for thirty to sixty minutes. It is well to scarify another single area and rub in a glycerin boric acid paste as a control. Glycerin and boric acid are used as the base of pollen extracts in paste form for diagnosis, and these pastes are said to retain their activity indefinitely; moreover, it is such an easy matter to apply them that several tests can be made at the same time with different pollen extracts in this form. If one pollen extract fails, another should be tested. When the reaction is very positive there may develop an inflamed itching zone 2 inches in diameter.

According to another plan the proteins are put up in capillary glass tubes resembling those used to contain vaccine for vaccination against smallpox. The contents of the tubes are applied to the scarified areas, or, by means of the needle several punctures are made intradermally at different points and the extract applied.

If timothy pollen is responsible, the use of its extract is indicated, and if ragweed pollen is the cause of the disease, ragweed pollen extract is to be used. In cases in which two reactions occur and are probably due to both pollens, an extract composed of both of them may be employed, but the use of multiple pollen extracts derived from various sources in the hope that one may be that which induces an attack is unwise, because it is in the nature of the old-fashion "shot-gun" prescription, and also because the actual dose of the specific agent really needed is too small to do good. If the attack is produced by different pollens it is best to give them separately, beginning with the pollen that appears earliest in the season. Treatment should be started about six to eight weeks ahead of the pollen period.

For prophylactic treatment, the extracts come on the market in strengths expressed in units. The unit is an arbitrary one and is that quantity of pollen protein that can be extracted from three one-thousandths of a milligram of pollen (0.003 mg.). The pollen protein, in the form of a glycerin extract, is put up in small vials, ready for use. There are three of these vials, each containing about 4 cc. of extract, but of differing concentration. Vial No. 1 contains 20 units to the cubic centimeter, Vial No. 2, 200 units per cc., and No. 3, 2000 units per cc. Beginning with 2 units, or 0.1 cc. from Vial No. 1 (more if the patient's resistance will warrant and the hay-fever season is near at hand), the antigenic treatment proceeds by easy stages, that is by gradual increase of the dosage, until perhaps 0.5 cc. of the 2000-unit extract is tolerated. Though dose schedules have been constructed, as below, the toleration of the patient is the safest guide. The injections are given at intervals of two to four days, according to the degree of the last previous reaction and its complete subsidence. By this means a full course of about fifteen injections, extending over six or eight weeks, can be given, and this is usually sufficient for prophylaxis. A syringe graduated in tenths or hundredths of a cubic centimeter is employed, the needle being thrust through the rubber diaphragm cap of the vial to obtain the quantity needed for injection.

The following table of doses is graduated to meet the average requirements, not only of safety but of efficiency, and is, of course, subject to modification, as stated above. In some cases it may be desirable to add a few more injections, rarely, however, exceeding 1200 units.

Dose.	Amount of extract.	Units.	
1st	0.1 cc.	2	20 Units per cc. Vial No. 1.
2d	0.2 cc.	4	
3d	0.4 cc.	8	
4th	0.8 cc.	16	
5th	1.25 cc.	25	
6th	0.2 cc.	40	200 Units per cc. Vial No. 2.
7th	0.3 cc.	60	
8th	0.5 cc.	100	
9th	0.8 cc.	160	
10th	1.25 cc.	250	
11th	0.2 cc.	400	2000 Units per cc. Vial No. 3.
12th	0.3 cc.	600	
13th	0.4 cc.	800	
14th	0.5 cc.	1000	
15th	0.6 cc.	1200	

Another method is to market vials containing four different strengths. The contents of each are diluted at the time of use. That in Vial A is employed for the first 5 doses, Vial B for the next 5 doses, Vial C for the next 5 and Vial D for the last 5.

The treatment, as already stated, is both prophylactic and curative, but pollen therapy is far more successful for prophylaxis than when the attack of hay fever is present, at which time the use of the extracts may increase the trouble of the patient or at best utterly fail to aid him. The first dose for prophylaxis should, if possible, be used many weeks before the expected onset of the disorder, with the idea of completing the immunization at least ten days before the time at which the seasonal attack has occurred in previous years. If due to the pollen from trees the injections should begin in January or February; for June hay fever, early in March; and for that due to timothy pollen, not later than the first week in April. So too for that type due to ragweed, inoculations should begin not later than May 20.

For lack of space it is not possible to give here the times at which different forms of pollen are given off, the more so because the same plants vary in their development in different areas of the country. Facts as to these variations, with a statement of the plants most frequently the cause of an attack, may be found in books devoted to hay fever and in the literature prepared by the manufacturers of the various pollen extracts.

Care should be exercised not to give an injection anywhere near the site of a former puncture.

The results obtained have been good in a sufficiently large number of cases to justify the employment of this plan in those who suffer from hay fever. The treatment usually has to be repeated every year to give relief.

PROTEIN THERAPY.

It is a clinical fact that in certain subacute and chronic infections the hypodermic injection of almost any foreign protein substance in sufficient dose to produce some evidence of reaction, as shown by a chilly sensation in three or four hours followed by fever of 102° to 104° F., will produce satisfactory therapeutic results. The manner in which this effect is produced is still undetermined. As long ago as 1919 Gow gave the following types of infection as suitable to protein therapy. They hold true to-day.

1. Infective disease in which the causal organism is unknown or not certainly determined—*e. g.*, rheumatic fever and acute toxic arthritis.
2. Infective disease in which the causal organism is known, but autogenous vaccine therapy is of little value—*e. g.*, gonorrheal arthritis.
3. Infective disease in which the causal organism is known and vaccine is given for both its specific and shock effect—*e. g.*, typhoid, paratyphoid, and coliform infections of the urinary tract.
4. Chronic disorders of unknown etiology—*e. g.*, psoriasis, pemphigus, and lupus erythematosus.

In certain cases of gonorrheal rheumatism, or arthritis due to other causes, very excellent results have been obtained and clinicians of wide experience have reported cases in which the benefit, near and remote, was so marked to make one hesitate to accept their statements. In some instances dead typhoid bacilli have been used. In others the white of egg in small quantity, and in still others sterilized milk or sterilized whey. In certain cases of puerperal infection 5 to 10 cc. of skimmed sterilized milk given into the supragluteal region have given excellent results. The milk is prepared by skimming it and then boiling in a double boiler for four minutes. The dose is given every third or fourth day. It is best to begin with the smaller dose and gradually increase it. The dosage is determined by the degree of reaction to the foreign protein be it *what it may*. An injection is usually followed by a marked chill in four to eight hours which may last for three hours. This is followed by a fever amounting to 101° F. lasting for six or eight hours and falling rapidly until the patient is afebrile twenty-four hours after the injection. This is especially true if there is a history of asthma or previous use of protein in this manner. Before foreign proteins are employed it is wise to test the patient to discover if he is sensitized as, if he is, mild or severe manifestations of anaphylaxis may develop. (For text see Besredka's Method under Antitoxin in Part III.)

It must not be forgotten that sensitization may be natural or induced by foreign protein given not only two weeks before but many months, or even years, before for some other curative purpose.

When the hypodermic dose fails to produce an active reaction the foreign protein may be given intravenously. When this is done the dose should be small, at least at first. In sturdy patients 100,000,000 dead typhoid and paratyphoid bacilli in the proportion of 2 of typhoid bacilli and 1 part each of paratyphoid A and B are injected in 5 cc. of normal saline. This dose is doubled every fourth day. If the patient is frail the first dose is 50,000,000. The dosage must depend upon the severity of the reaction. On the one hand the patient must not be too "hard hit" and on the other it is to be recalled that the more severe the reaction the better the ultimate result. Manifestly no treatment can be expected to greatly benefit patients with great structural changes. Except for marked cardiac feebleness there seems to be few contraindications, but old tuberculous and syphilitic lesions may flare up under protein therapy. Nevertheless protein therapy in the form of dead paratyphoid and typhoid bacilli has been resorted to with considerable success in the treatment of all stages of *syphilis* but its use twice or thrice a week is best combined with arsphenamine or neoarsphenamine given once a week at the height of the fever induced. Occasionally if added to standard treatment it will correct an otherwise fixed Wassermann reaction. It not only corrects secondary symptoms, but if used with tryparsamide seems to be of value in *nervous syphilis*. It is often well to follow this combined treatment with a course of bismuth.

Protein therapy is contraindicated in the presence of marked myocardial disease and arterial sclerosis.

Under the name of Aolan a protein product gives excellent results. It is claimed that it does not produce general reaction in the sense of chill and fever but only a local reaction as hyperemia or increased secretion in the part infected. It is a colloidal lactalbumin solution made from cow's milk devoid of dead bacteria, or their toxins, or preservatives. It appears on the market in sealed ampoules of 1 cc., 5 cc., 10 cc. and

25 cc., and is injected intramuscularly as is mercury salicylate (which see, Part II) for general infections or deep-seated localized infections, the starting dose being usually 10 cc. or 5 cc. to a child. It is also given intradermally in lesions of the skin of an infectious nature, not in the area involved but on the extensor surface of the forearm, by means of a very fine needle in the dose of 0.2 or 0.9 cc. (2 to 5 minims) two or three wheals being induced at an injection. Whether the dose is large or small it is given at intervals of three to four days until recovery ensues. A similar product made in this country called "Lactogen" is used for the purposes already mentioned and has been also employed in *epididymitis, bubo, chancroid* and *slowly healing ulcers* with asserted success. Still another (Activin) containing iodine, is given in starting doses of 0.5 to 1 cc. according to the degree of reaction, which should not be severe. It is given intramuscularly through a plated needle as it changes color on contact with steel. It is given not oftener than every third or fifth day.

It is important to bear in mind that the curative results are best obtained, the earlier protein therapy of any kind is instituted. When vitality is at a low ebb, locally or generally, relatively little good effects can ensue for obvious reasons and, in those greatly devitalized, a severe reaction in the sense of a severe chill and fever may be definitely harmful.

It is probable that the good results which sometimes ensue after the use of so-called vaccines may depend more upon their effects as foreign proteins than upon any specificity.

REST CURE.

The rest cure is a method devised and elaborated by the late S. Weir Mitchell, of Philadelphia, for the relief of a large class of patients who, for various reasons, are generally ailing from apparently no organic disease, and yet whose condition is often so alarming as to lead to the belief that some hidden cause of a severe train of symptoms must be present. In many such instances a careful study of the case will show that there is a cause, near or remote, which has exhausted the patient's vital forces without producing anything else than functional disturbances of the body. Thus a prolonged nerve strain in nursing a sick relative may so exhaust the strength of a hitherto healthy woman as to produce *hysteria, anemia,* and great disturbances of nutrition, or, in another instance, cause *neuralgia, disordered menstruation,* and *uterine or ovarian pain.* In males, mental, sexual, or physical vigor may be impaired, owing to prolonged anxiety in business. Be the symptoms what they may, as long as they are dependent upon nerve strain, this "cure" is to be resorted to, and if properly carried out is often attended with surprising results. It is also a valuable means of treating *functional* and *organic heart disease.* Before describing the method in detail it is proper to state that its entire *rationale* rests upon the remembrance that every movement is an expenditure of force, and that a system which has already overdrawn its reserve fund of strength must be as careful with its funds that remain as a bank should be under the same circumstances.

It having been decided that the rest cure is to be employed, the directions are given as follows:

A bright, airy, easily cleaned, and comfortable room is to be selected, and adjoining it, if possible, should be a smaller one for an attendant or nurse. The patient is put to bed and kept there for from three to six weeks, or longer, as may be necessary, and during this time is allowed to see no one except the nurse and the doctor, since the presence of friends requires conversation and mental effort. No correspondence is permitted. The patient in severe cases must be fed by the nurse in order to avoid the expenditure of the force required in the movement of the arms. No sitting up in bed is allowed, and if any reading is done it must be done by the nurse, who can read aloud for one hour a day.

In the case of women the hair should be dressed by the nurse to avoid any physical effort on the part of the patient.

To take the place of ordinary exercise two measures are employed, the first of which is massage or rubbing of the body, the second electricity. By the kneading and rubbing of the muscles and skin the liquids in the tissues are absorbed and poured into the lymph-spaces and a healthy blush is brought to the skin. This passive exercise is performed in the morning or afternoon, and should last for from one-half to one hour, every part of the body being kneaded, even the face and scalp. In the afternoon or morning the various muscles should be passively exercised by electricity, each muscle being made to contract by the application of the poles of the battery to its motor points, the slowly interrupted current being used. Neither of these forms of exercise call for any expenditure of nerve-force, though they keep up the general nutrition. The following programme for a day's existence is an example of what the physician should order:

7.30 A.M. Glass of hot or cold milk, predigested, boiled, or raw, as the case requires.

8 A.M. The nurse is to sponge the patient with tepid water or with cold and hot water alternately, to stimulate the skin and circulation, the body being well wrapped in a blanket, except the leg or portion which is being bathed. After this the nurse should dry the part last wetted with a rough towel, using some friction to stimulate the skin.

8.30 A.M. Breakfast. Boiled, poached, or scrambled eggs, milk toast, water toast, or a finely cut piece of a mutton-chop or chicken.

10 A.M. Massage.

11 A.M. A glass of milk, or a milk-punch, or egg-nog.

12 M. Reading for an hour.

1 P.M. Dinner. Small piece of steak, rare roast beef, consommé soup, mutton broth, and any one of the easily digested vegetables well cooked.

3 P.M. Electricity.

4.30 P.M. A glass of milk, or milk-punch, or egg-nog.

6.30 P.M. Supper. This should be very plain, no tea or coffee, but toast and butter, milk, curds and whey, or a plain custard.

9.30 P.M. A glass of milk or milk-punch.

In this way the day is well filled, and the time does not drag so heavily as would be thought. If the stomach rebels at overfeeding, the amounts of food must be cut down, but when all the effort of the body is concentrated on respiration, circulation, and digestion a large amount of nourishment can be assimilated by the exhausted body, which before this treatment is undertaken may have had its resources so shattered as to be unable to carry out any physiological act perfectly.

For the treatment to be successful the rules laid down should be rigidly followed.

TRANSFUSION.

SEE ALSO INTRAVENOUS INJECTION.

The term transfusion is used in medicine to signify the transfer of blood from one person to another, whereas an intravenous injection is one in which other fluids than the blood are introduced into the vascular system. (See Intravenous Injections.) Transfusion is indicated in the following conditions:

1. Anemia of a severe degree due to acute hemorrhage arising from any cause.
2. In severe anemia arising from a prolonged loss of blood from any lesion.
3. In cases of severe anemia induced by hemorrhage depending upon hemophilia or blood dyscrasia when the donor's blood not only supplies normal blood but the elements which will induce proper coagulation, as in *hemophilia, purpura hæmorrhagica, splenic anemia* and *acute hemolytic jaundice.*
4. In *pernicious* anemia for temporary relief. Until liver extracts or ventriculin begin to take effect it may be necessary to give blood three or four times at frequent intervals in order to preserve life.
5. In some cases of severe *bacteriemia.*
6. In severe, extensive, *burns* to combat the toxemia and aid in regulating acid-base equilibrium.
7. In certain cases of *chronic nephritis* and *chronic arthritis* complicated by severe anemia.
8. In patients with carcinoma and severe anemia to make surgical intervention more feasible and to prolong life.

9. In cases necessitating surgical intervention that are complicated by jaundice, prolonged clotting-time, severe anemia or great fluid loss.

10. In postoperative cases that present slow healing, foul suppurative wounds, and those with severe anemia, to shorten convalescence and stimulate healing.

11. In conditions characterized by great fluid loss as prolonged and severe vomiting, dysentery or cholera.

12. In puerperal sepsis or bacteriemia complicated by anemia.

There are four difficulties which stand in its way.

1. To find a donor.

2. To find a donor whose blood will be compatible with that of the donee.

3. The prevention of clotting during the transference of blood by indirect transfusion.

4. The difficulty of dealing with the vessels of the donee, which vessels are often collapsed, very easily torn, or buried in fat. When this is the case the vein should be exposed by an incision.

The first difficulty is overcome by friendship or cash. The second by testing the blood of the prospective donor until one is found which is compatible. If this cannot be done choose a Type IV (Moss) donor as the chance is greater that his blood will match the patient's. If such a donor is not available use a blood relative as it is probable that he will be the same type. If neither of these are possible and it is a matter of "life or death" use any available donor. Inject 10 to 20 cc. and wait five minutes. If no sign of reaction is present, in all probability a hemolytic reaction will not occur.

The third by the mixing of the blood with some anticoagulant, such as sodium citrate solution. The fourth by technical skill and the choice of suitable bloodvessels in a given case.

The blood of the donor should also be tested by the method of Wassermann to exclude syphilis; any statement of the donor as to his freedom from syphilis being liable to error, particularly in the case of paid donors.

A young male adult is more satisfactory than one who is old and, if possible, a donor with good veins should be obtained.

Cross matching (see below) should be performed before each new donor is used, or if any intravenous medication has been administered, or if an anesthetic has been given between transfusions the agglutinin titre may be so altered that hemolysis will result from the use of that donor.

Usually the immediate effect of the withdrawal of between 400 and 500 cc. of blood is very slight. The donor is able to go about his duties at once and does not complain of any symptoms of blood loss. During the transfusion there is usually a slight fall of blood-pressure. The coagulation time is slightly lengthened and the red blood cells and hemoglobin fall off from 5 to 10 per cent. These elements return to normal in three to four days. Male donors between the ages of twenty and forty-five years may donate every three to five days for 4 or 5 donations if 400 cc. or less are given each time.

When larger amounts are given viz. 600 to 1000 cc. an interval of two to four weeks should elapse before more blood is given or until the blood has been at least 75 per cent regenerated.

Female donors are not as satisfactory as males because usually their veins are small, embedded, because an anemia develops more quickly, and the return to normal is slower if the amount donated is 400 cc. or more. If a female donor wishes to give several donations the amount of each should be 300 cc. or less.

It is well known that the blood serum of one person may cause the agglutination of the blood cells of another person. This agglutination produces serious immediate effects from hemolysis and nullifies the good effect of the transfusion. It has been found that the blood of human beings is capable of being put in four groups but each method of grouping is different. There are various methods of grouping. Although Jansky (1907) was the first to determine this, the Moss (1910) grouping is most widely used. Type I Moss is Jansky IV. Type IV Moss is Jansky I. Type II and III are similar. Having two classes confusion often arises in Type I and Type IV donors. To obviate any difficulty a third group known as the International has been suggested. This grouping is based upon the letters used to designate the agglutinins of each type, as follows:

Moss.	International.	Jansky.
Type I	A B	IV
Type II	A	II
Type III	B	III
Type IV.	O	I

There is difference of opinion as to the relative value of those methods of grouping but that of Moss is adhered to in the text as it is the one generally employed.

The blood of a given group is usually compatible with the blood of its own group.

To type blood—1. Place in test-tube 2 cc. of 1 per cent sodium citrate in normal saline, or 1 cc. if patient is very anemic and 1 drop of the patient's blood.

2. Place a drop of this in each of two hanging drop chambers.

3. Add a drop of serum II[1] to one and a drop of serum III to the other. Surround cover glasses with vaseline.

4. Place under the microscope, low power, and observe for thirty minutes.

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[1] The standard serum II and III may be obtained from any one of several pharmaceutical houses.

5. If agglutination occurs in both it is Type I. If agglutination occurs with III serum but not with II it is Type II. If agglutination occurs with Type II serum but not with III it is Type III. If agglutination occurs with neither sera it is Type IV. The great advantage of typing is to make up a list of donors thereby facilitating cross matching when a transfusion is to be performed.

Cross matching or cross agglutination should always be done if possible.

1. Provide a 1 per cent solution of sodium citrate in normal salt solution.
2. Take two pipettes such as are used for counting white corpuscles.
3. Draw up in one pipette 1 part of sodium citrate solution and 10 parts of the blood of the donee (patient).
4. Do the same thing with the donor's blood in the second pipette.
5. Mix 9 parts of the contents of the donee's blood tube with 1 part of the donor's fluid.
6. Mix 9 parts of the contents of the donor's blood tube with 1 part of the contents of the donee's tube.
7. Place a drop of each mixture on a slide and add a drop of normal saline to each slide.
8. Cover each with a cover-glass, surround with vaseline, and place each slide under a microscope.
9. If after thirty minutes no agglutination has occurred on either slide the bloods of the donor and donee are compatible, that is, fit for transfusion. By this means the compatibility of the cells and the serums are both tested.

It has been found that the blood serum of a person in Group I does not agglutinate the cells of any other group so to this group has been given the name "Universal Recipient." This term is faulty because its corpuscles may be agglutinated by the serum of every other group. The cells of Group IV are not agglutinated by the serum of any group. Hence the unfortunate term "Universal Donor." The use of the so-called "Universal Donor" without cross matching has been responsible for many fatalities. For even though the blood of the donor and patient are of the same type and both Type IV, marked agglutination may occur. It is true, however, that a Type IV blood will match with more types of blood than any other.

The quantity of blood transferred in an adult averages about 400 to 500 cc. After acute hemorrhage if the hemoglobin is:

70 to 80 per cent give	500 cc.
60 to 70 per cent "	600 cc.
45 to 60 per cent "	700 cc.
30 to 45 per cent "	800 cc.

It is desirable in hospitals to be able to have on call representatives of each group who are in health and willing to give blood. When a patient needs a donor his group is determined and his suitable donor sent for, but even if the latter is recorded as of the same group, it is best to make the tests already referred to before actual transfusion, because an individual who has been tested before may change his group.

In an emergency a donor of Group IV (Moss) will be less likely to cause trouble than any other donor, as already stated.

When life is in danger from an acute hemorrhage and a donor of the same type cannot be had in time it is proper to inject from 10 to 20 cc. of blood and if no irritating or respiratory disturbance takes place after ten minutes to proceed as if the type was established.

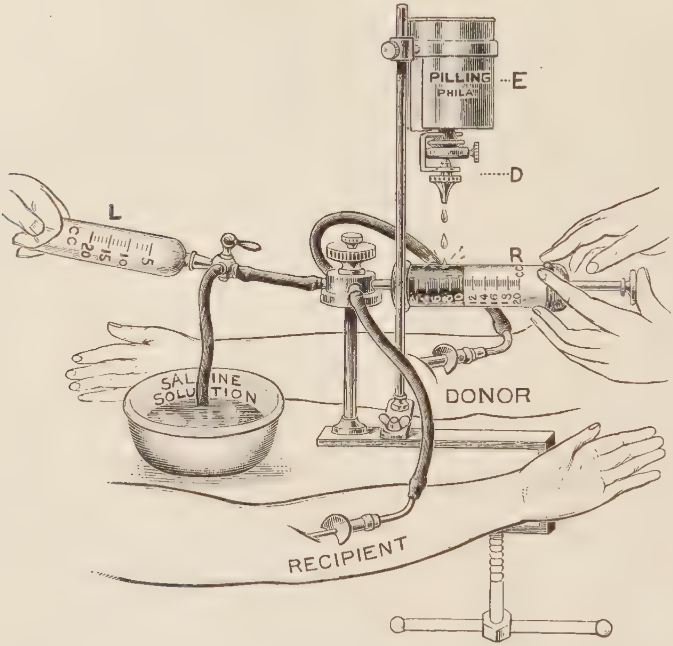

Fig. 108.—Transfusion apparatus of Unger. (Modified by H. M. Jones.)

If the question of subsequent transfusions be considered at a later date it is proper to repeat the agglutination tests a second time, even when the same donor is employed, and if ten days to two weeks have elapsed the danger of anaphylaxis is to be considered. This can be avoided by the use of each subsequent injection at shorter intervals and by Besredka's test described in the article on Antitoxin.

A simple method for whole blood transfusion is a modification of that devised by Unger (Fig. 108). The apparatus is characterized by its simplicity. Whole blood can be transferred rapidly without coagulation and without injection of air. One hundred cc. of blood can be transferred per minute or a pint in five minutes. In nearly 3000 transfusions I have never had a failure; never had clotting of blood and in only 3 cases has it been necessary to expose the vein. It can be performed in the patient's room or home with as much ease as in the operating room.

The recipient and donor should be as nearly as possible on the same level. The same arm of each is used; therefore, they oppose one another, feet to head. A table or a board is placed between so that the arms may rest upon it. The instrument is clamped on the table or board.

The operator always faces the recipient.

The assistant always faces the donor.

The steel cylinder containing two grooves, is held in place by a screw and is rotated by the operator so that when the pointer is toward the donor the flow of blood is from the donor through the groove to the operator's syringe. At the same time the other groove transmits normal saline from the assistant's syringe through the rubber tubing to the recipient thereby giving a continuous flow of fluid. Now, when the cylinder is turned and points toward the recipient the blood in the operator's syringe goes through groove to the recipient and the assistant's salt solution keeps the donor's blood from entering his syringe. Ether drops in a very fine stream upon the operator's syringe during the operation. This tends to prevent to a slight degree coagulation and prevents the steel cylinder of the operator's syringe from sticking. In administering 500 cc. of blood, 20 to 40 cc. of salt solution is all that is necessary to give.

It is essential to have a large caliber needle for the donor. The needles are of two parts; a sharp inner part and a duller outer part. The inner portion is withdrawn after the needle is well in the vein and the dull portion remains. The collar holds the needle in place on the arm. The curved tip is to attach tubing to the donor's needle. The straight tip is used to attach rubber tubing to the recipient's needle.

Operation: Wash arms with alcohol.

Apply tourniquet so that veins are fully distended but the pulse is full and strong.

Insert the donor's needle against flow of venous blood.

Insert the recipient's needle in direction of the flow; that is from the wrist to the shoulder.

After each needle is inserted, hook up tubing to them and use the syringe to withdraw and deliver the blood. These procedures are continued until sufficient blood is transfused. If the donee begins to cough or complains of a sense of oppression after 200 cc. have been injected, the transfusion should be stopped at once as these are signs of hypertransfusion. The quantity used varies with the needs and size of the patient. Usually from 60 to 150 cc. are used for infants and from 300 to 600 cc. for adults.

When the patient is restless it may be best to expose the vein, nick it with scissors and use a cannula which fits the syringe and has a shoulder to hold it in the vein by the tying of a ligature.

In infants it is almost impossible to use a vein in the arm. The needle in such cases should be passed into the great saphenous vein just in front of the internal malleolus. If it cannot be felt or seen it is easily exposed by an incision. In very young children the longitudinal sinus in the middle line at the posterior extremity of the fontanelle may be used.

Exsanguination transfusion, as such, is applicable only in small children. An attempt is made to remove all the blood and replace it with blood from one or two donors. In adults, as much blood as can be replaced from available donors is withdrawn. This plan is of value in bacteriemia, toxemia and burns unaccompanied by severe anemia.

By auto-transfusion is meant the replacement of the patient's own blood. In certain cases of ruptured extra-uterine pregnancy blood may be collected from the abdomen, citrated, passed through gauze and injected intravenously. (See next page.)

A very much simpler plan possessing the advantage that the blood can be taken from the donor at one place and carried almost any distance to the donee is the so-called citrate method. A sterile 2 per cent solution of sodium citrate is prepared, of which 10 cc. are to be added to each 100 cc. of blood. (See Intravenous Injection.)

An ordinary Erlenmeyer flask is fitted with a cork, through which are passed three glass tubes, two of which are short and one long enough to reach nearly to the bottom and bending toward the side of the flask. A rubber tube armed with a large needle is attached to one short tube. Another rubber tube is attached to the second short tube and its distal end to the suction, or vacuum, nozzle of a pump, such as is used to produce a vacuum in an aspiration apparatus. A third rubber tube is attached to the external end of the long glass tube, and it is armed at its distal end by a second needle and clamped. Sodium citrate solution is placed in a sterile beaker, the first needle is immersed in it and the suction pump is put in play. This puts the citrate solution in the flask and tests the efficiency of the apparatus. Just before the last part of the citrate solution is about to be sucked up clamp the rubber tube above the needle. Then push the needle into the donor's vein distally and immediatelly remove the clamp so that the vacuum in the flask can draw the blood. The vacuum may be maintained by use of the pump. Gently rotate or shake the flask to thoroughly mix its contents while the blood is flowing. When the amount drawn is adequate, say 500 cc., apply the clamp to the donor's tube once more, and withdraw the needle from the vein. Change the pump so that the output nozzle is inserted into the same tube as has been occupied by the suction nozzle. Remove the clamp on the rubber tube, which is attached to the long glass tube and pump in air until the fluid flows from the tip of the second or donee's needle. Again clamp for a moment while the needle is inserted in the vein of the donee toward the body, then remove the clamp and keep the citrated blood flowing by producing a positive pressure with the pump.

The container of the blood should be kept warm, or if the blood is to be carried some distance the citrated blood container should be warmed before it is injected by immersion in hot water, so that its temperature in the injecting flask is about 110° F.

The citrate method is more prone to produce a chill and febrile reaction than the pure blood method, and so is not so safe in those who are exhausted by disease or who are in a grave condition as the result of prolonged bleeding, as, for example, in cases of profuse uterine hemorrhage. The fever begins about one-half or three hours after injection, may be as high as 102° or 104° F., and may last eight to twelve hours. Urticaria is not uncommon as a sequel.

In general terms it may be stated that when transfusion is resorted to in anemia and infections whole blood is best. When employed in acute anemia due to hemorrhage the citrate method is justifiable. Long after I wrote these words Sir Almroth Wright, in discussing this subject, said: "Citrated blood should not be used, since it pulls down the power of the leukocytes." This view has been confirmed by the experiments of Thornton of the U. S. Navy who has not only proved that citrated phagocytes are impaired in their activity but also that the complement in the serum is diminished so that its power to destroy bacteria is decreased.

The amount of blood taken from a donor of 150 pounds should not exceed 600 cc. at one bleeding.

Under the term immuno-transfusion a method of treating general sepsis has been resorted to with some success. The transfusion of normal blood having seemed to promote recovery in certain cases, an effort is made to raise its efficiency by the following method, the design being to increase its content of antibodies and complement. With this object in view, vaccines are given the donor by the hypodermic needle. It would appear that a microörganism identical with that present in the patient is not essential, the staphylococcus, streptococcus, and Bacillus typhosis all acting equally well. When the staphylococcus is employed the dose to the donor should be about 1000 million, and the blood of the donor should be utilized after the lapse of about five hours as it gradually loses its value after this time, losing all increased power after forty-eight hours. The quantity of blood transfused varies from 50 to 150 cc. It is best to use direct transfusion but when the donor and donee cannot be brought in contact the citrate method may be resorted to. The transfusions should not be repeated oftener than every second day.

Autotransfusion is used when as the result of a ruptured extra-uterine pregnancy a serious loss of blood has taken place into the abdomen. The blood is taken from the cavity, mixed at once with 10 cc. of a 2 per cent solution of sodium citrate to each 100 cc. of blood, strained through several layers of gauze to get rid of clots and then injected intravenously after being warmed to body temperature.

VACCINE THERAPY.

Vaccine therapy consists in the injection into the subcutaneous tissues of dead germs identical with those living germs inducing the disease; the introduction of living germs being dangerous for obvious reasons. In general terms it may be said that vaccine therapy is of much less value than it was thought to be at one time with certain exceptions.

The term vaccine therapy is a misnomer, in that it conveys the idea that the method of cure consists in treating the patient by scarifying the skin and inoculating the patient with living germs, as in the process by which we immunize a person to smallpox by means of cow-pox virus. It is also a misnomer because it leads to the belief that some part of the process has to do with a calf or cow ("*vacca,*" a cow), when, as a matter of fact, this animal is not even remotely connected with it. Again, it is a misnomer because, as a rule, dead germs are inoculated. A better term would be inoculation therapy, but the phrase vaccine therapy is so well established that it has probably come to stay.

It is absolutely essential that the germs used, or the toxins used, be of the same kind as the organism already producing the abnormal state, and not only must the organism be of the same kind, but often of the same strain if it is to be effective. Because the introduction of these germs renders the already present invaders susceptible to phagocytosis, or, in other words, makes them fit to be devoured, it is said that opsonins are developed in the blood, or tissues, from the Greek word *οπσονιν*, "I cater for," or "I prepare food," and for this reason vaccine-therapy is often correctly termed "opsono-therapy."

Physiological Action.—Among the vital processes by which the body protects itself from invading microörganisms is phagocytosis, or the swallowing and destruction of germs by those white blood-cells which possess this function as a result of which they are called phagocytes. If the body is in health and the invading army of germs is not too large or too virulent, so many of the invaders are overcome by this and other protective measures that illness does not occur, or, if it does, recovery ensues. Conversely, if the phagocytes are not up to their work, illness and death may ensue.

When a suspension of dead bacteria in sterile normal salt solution is injected subcutaneously or intramuscularly, certain definite processes ensue. The body contains in its cells and juices a ferment or substance which possesses the power of dissolving bacteria. This complement cannot act, however, without the aid of another factor called an amboceptor, which serves to connect or link the complement to the bacterium. The amboceptor is produced by the body as a result of the injection (Effect 1). When it links the complement to the bacterium the latter is dissolved or disintegrated (lysis) (Effect

2), and the poison in the cell is set free (Effect 3). This poison develops a factor (opsonin) (Effect 4) which renders the living bacteria in the body susceptible to the attacks of the phagocytes (Effect 5). The phagocytes devouring the bacteria set free their poison (Effect 6), and this poison in turn produces more opsonin (Effect 7). This poison also induces the development of additional protective measures, namely, the appearance of increased bacteriolytic power (Effect 8) and, again, it stimulates the production of antitoxin (Effect 9).

An examination of the phagocytes, when brought into the presence of the infecting germ under the microscope, shows that at first their ability to destroy the invaders is somewhat decreased, and this is called the "negative phase;" but later they rally, the germs are rendered more susceptible, and phagocytosis is very active—the "positive phase." It is, therefore, evident that for the accurate application of vaccine therapy the physician must be skilful in the examination of the blood and in bacteriological methods, that he may study phagocytosis and differentiate and then cultivate the specific germ which is causing the infection. Furthermore, it has been found that the skill to determine opsonic activity is so great that even those who work at it constantly often fail to get accurate results. For this reason accurate vaccine therapy is limited to those who are so situated that a competent bacteriologist and opsonic estimator is at hand to assist. The result is that accurate or precise methods have to be cast aside in many cases, the physician sending a specimen to a laboratory to have the kind of infecting organism determined, and then injecting into the patient a "stock vaccine," that is, one put up by dealers in biological products, or he waits until the bacteriologist not only determines the germ, but grows it by cultural methods, and provides the physician with what is called an "autogenous vaccine;" that is, one made from the patient's own germs. The number of dead organisms in a given quantity of salt solution is stated on the label, and the dose is gauged by this means (see Dosage).

It is evident, from what has been said above, that at the best this plan of treatment is open to many chances of failure, and it is also to be borne in mind that if the patient is in a state of very low vitality because of the existing infection, or because of an antecedent illness, he may be damaged by an injection, because the "negative phase," or period of decreased phagocytic activity, may be exaggerated, and the "positive phase," or increase in phagocytosis, may never occur. In other words, we push the drowning man under water instead of stimulating him to increased effort to save himself. In the presence of very grave infectious illness, therefore, vaccine therapy is not permissible unless a competent worker in opsonic estimation is able to assure us that the tissues of the body are capable of preparing the germs for phagocytosis.

There is, therefore, a marked difference between vaccine therapy and serum therapy. In the former we stimulate the body to develop substances with which to aid in its protection; in the latter, we give the body antitoxic substances already prepared by another and healthier animal. Furthermore, it commonly happens that the patient is infected not only by one organism, but different strains of that organism, or by a number of different microörganisms. It, therefore, becomes necessary to employ a vaccine that represents all the strains or kinds present. When only one strain is present it is called a univalent vaccine, when more than one strain is used it is called a polyvalent vaccine, and when the vaccine is composed of more than one organism it is called a "mixed vaccine." Because of lack of laboratory facilities physicians often use a mixed or a polyvalent vaccine in the hope of hitting the offending germs, as in the old "shot-gun" prescription. They also are often forced to use stock vaccines for the same reasons, and while this cannot be considered accurate, it is the best thing that can be done in many instances. In any event the kind of germ causing the illness must be determined, as otherwise the treatment is futile and may be even harmful. Then, too, it is to be recalled that in most cases there are infections associated with the main infection, and this justifies the use of a mixed vaccine if the associated germs are isolated with the chief agent. This is notably the case in acute catarrhal conditions of the mucous membranes of the upper respiratory tract. In these states a multiple mixed vaccine is employed, containing as its chief agent the staphylococcus, with the streptococcus, pneumococcus, the micrococcus catarrhalis, the bacillus of Friedländer, and the bacillus of epidemic influenza. Few persons are willing to submit to prophylactic injections to prevent colds, and after a cold is begun the use of such a vaccine seldom cures in less time than is usually consumed in getting well.

Without doubt those infections due to the Staphylococcus pyogenes aureus and albus are the ones which yield best to vaccine therapy. As, for example, certain types of acne pustulosa and furunculosis, wound infections, cellulitis, and abscess in the subcutaneous tissues. If the acne is due to the Bacillus acne, that specific vaccine must be used.

When the infectious process is due to streptococci the results of vaccine therapy are often disappointing, perhaps because this microörganism occurs in many different strains. The best results have been obtained from the use of autogenous antistreptococcus vaccine in puerperal sepsis, and in localized or limited infections rather than in widespread infection of the entire system. Nevertheless, in erysipelas, which is a local and general infection by the streptococcus, this plan of treatment nearly always fails.

In pneumococcus infections the results are fair if the treatment is used carefully. It gives less good results in pneumonia than in localized pneumococcic infections elsewhere than in the lung.

In typhoid fever vaccine therapy may modify the severity of the disease, but it does not shorten its duration.

In infections by the Bacillus coli, as in the kidneys and bladder, vaccine therapy often gives excellent results, and in all forms of gonococcus infection save in acute gonorrheal urethritis it is often very effective. (See also Antigonococcic Serum.)

Dosage.—This differs in different infections and in different cases. Unlike antitoxic serum, which should be in large dose in direct proportion to the gravity of the illness, vaccines, when they are first used, have to be given in inverse ratio to the gravity of the illness for reasons already stated. A high fever contraindicates their use.

Having determined the kind of infection, the general state of the patient should be considered and, if possible, his "opsonic index"[1] determined. If he is very feeble, the early doses should be very moderate, and if he appears worse after their use the size of the dose must be decreased.

In general terms the doses of the several vaccines for curative purposes are approximately as follows:

Staphylococcus	100,000,000 to 1,000,000,000	at a dose.
Streptococcus	5,000,000 to 200,000,000	at a dose.
Gonococcus	5,000,000 to 500,000,000	at a dose.
Bacillus coli	10,000,000 to 200,000,000	at a dose.
Cholera	500,000,000 to 1,000,000,000	at a dose.

The dose is given according to need; that is, only when the phagocytic power, after its increase, is on the wane; if the opsonic index cannot be had, then as soon as the patient fails to continue to improve. Very rarely are the doses given oftener than every day, usually every second or third day. The dose is increased only when the dose previously given fails to produce increased phagocytic power or the patient fails to get better. If he is very ill, they should be reduced or they may overwhelm him. The more acute the illness, the less of the dose. If the reaction consists in a chill, vomiting and collapse, the dose is far too large.

In gonorrheal infection the dose is repeated about every four or five days. When pertussis vaccine is employed the dose should not be repeated in less than five days. It seems to do better as a prophylaxis than as a cure.

In all cases the injection is given in some part of the body not well endowed with sensation, yet well supplied with vessels and lymphatics, as the belly wall or back. Intravenous injections are not used because they may overwhelm the patient, and there is reason to believe that the specific substance is produced locally in the tissues and carried away by the blood or lymph stream. Indeed, it has been suggested that the best results will follow several small injections, in different areas, at one time, than when one single large dose is given in one place, since several foci for the production of complement or other useful substances will thereby be established.

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[1] The opsonic index is the difference between the ability of the phagocytes of the patient and the phagocytes of a healthy person to destroy, or consume, a number of the specific oganisms present in a given time.

Prophylactic vaccine therapy is carried out to protect persons who may be, or have been, exposed to certain common infectious diseases. Thus, typhoid fever can be entirely prevented in armies and in hospital attendants by this means. The dose injected is about 500,000,000 followed in seven days by another dose of 500,000,000, and a week later by another dose of 1,000,000,000. When it is thought that definite exposure to infection has occurred, or by reason of pressure as to time, the injections may be given every third day or even every second day. The best point for injection is in the loose tissues below the clavicle or into the outer aspect of the arm, not intramuscularly. In less than twelve hours a local reaction develops and nearby lymph nodes may become swollen. No general symptoms may develop, but commonly a slight febrile movement and languor, lasting for a day after the first dose, is produced. For these reasons in civilian practice it is better to givethe dose on Saturday afternoon so that the effects will be off before the need of going to work arises. Active exercise is to be avoided for twenty-four hours. Antityphoid vaccine is contraindicated in the weak and feeble, in menstruating women, and in the presence of any febrile process. When used the individual must abstain from all alcoholic drinks during the immunizing period. Typhoid vaccine is not curative.

In order to protect not only against typhoid fever but against the paratyphoid bacillus A and B, a vaccine made up of 500,000,000 typhoid bacilli and 250,000,000 each of the paratyphoid type is now generally used in order to protect against all these infections.

During the World War out of an average strength of 2,121,396 men in the U. S. Army there were, between September 1, 1917, and May 2, 1919, 213 deaths from typhoid fever. If the conditions had been the same as during the Spanish-American War the number of deaths would have been 68,164.

When antityphoid inoculation is given a child between seven and twelve years, one-quarter of adult dose is used, one-half from twelve to fifteen years, and two-thirds from fifteen to eighteen years. For prophylactic purposes ordinary vaccines are best, but if vaccines are used to combat typhoid fever already developed it would seem best to use sensitized vaccines. (See below.)

The period of time during which protection lasts as to infection by the typhoid bacillus varies in different individuals and perhaps by reason of ingestion of a heavy dose of virulent bacilli, but it is generally placed at about two years.

Vaccines are also used as prophylactics against cholera and *typhus exanthemicus* and *recurrentis*.

As to cholera, Schöbl and Amdaya in the Philippines determined that a dose of 500,000,000 induces an immunity of about four to five months and 1,000,000,000 for six to eight months but that during the first five days after injection susceptibility is increased.

All these vaccines are now placed on the market in glass bulbs or in syringe containers ready for immediate use. The syringe container is the best form, as the barrel is so marked that any dose less than its full contents can be measured by pressing on the piston without exposing the contents. When a large number of persons are to be treated, as in the use of antityphoid vaccination, the suspension of bacilli is kept in a sterile bottle covered with a rubber diaphragm, through which the needle of a hypodermic needle is plunged and the dose of suspension withdrawn.

Lipo-vaccines differ from ordinary vaccines in that the organisms are suspended in oil instead of salt solution. Because of the oil the entrance of the active ingredient of the germs into the general system is slower and for this reason their immediate effects are not so sure but larger doses can be given at one treatment. They are not popular.

Sensitized Vaccine.—Sensitized vaccine is one in which the specific bacteria producing a disease have been brought in contact with and have absorbed, or united with, antitoxin produced in an animal by the introduction into its body of the toxin of the same microörganism. This immune serum is identical in its effect with that of the amboceptor already described, and therefore the body of the patient does not have to produce an amboceptor before the complement can begin its process of dissolving the germ. It is to be understood, however, that the use of a sensitized vaccine is not equivalent to the use of vaccine treatment plus antitoxin treatment.

It has been proposed to use living sensitized bacteria on the ground that as they are sensitized the tissues can attack and destroy them before they can multiply sufficiently to do harm. So far, however, this is considered dangerous because, unless the sensitization is so nicely adjusted that the protective processes can act at once, the patient may have added to his old infection a new infection.

The advantages of sensitized vaccines over ordinary vaccines consist in the following points, so far as we can tell from experiments on animals and limited tests on man.

(*a*) They cause little or no reaction or inflammation at the point of infection.

(*b*) They are less prone to produce systemic symptoms, such as fever and general wretchedness, although the exact reason for this is not very clear.

(*c*) Because of (*b*) they can be given in large doses and more frequently.

(*d*) They develop immunity or protection more rapidly.

(*e*) Because of (*b*) they can be used in cases in which the illness is more severe without so much danger of the "negative phase" being unduly prolonged or so severe that the positive phase is never reached.

The sensitized vaccines possess the disadvantage that the immune serum used to sensitize must be produced by exactly the same bacterium as that injected and that infecting the patient, in order to combine with the bacterium used for injection. If this is not the case the injection is no better than ordinary vaccine. In acute illness there is not time, as a rule, to prepare even an autogenous vaccine, still less to make immune serum. In other words, in most instances, we use a "stock sensitized" vaccine, so-called, hoping that it has been provided with the proper amboceptor.

For the reasons just given, the doses of sensitized vaccine are, theoretically, considerably in excess of ordinary vaccines, but it is safer to begin with ordinary vaccine doses and increase rapidly if no reaction ensues.

Vaccine therapy has not stood the test of clinical and laboratory investigation as well as it was hoped it would. At times it seems to give excellent results in an individual case and, again, utterly fails. In some instances this is due to the use of a different strain of organism from that inducing the disease, to the presence of mixed infection, or to the dose being too small to do good or so large as to decrease rather than increase vital resistance. In other words, the primary negative phase may be too severe and the patient never gets the secondary positive phase or benefit. While on the one hand autogenous vaccines seem to give the best results, on the other hand it has been shown that the injection of any foreign protein or toxin may seemingly cause such an arousing of the vital processes as to result in cure. (See Protein Therapy.) When two large series of cases of a given disease are tested, one with vaccine and one without, and every element of fallacy which can be excluded is excluded it frequently happens that the non-vaccine cases show a better percentage of recoveries than those receiving vaccine. The writer believes that the field of efficiency of so-called vaccines in treatment, in distinction from prophylaxis, is constantly narrowing, and that before long this plan of treatment may be perhaps considered obsolete except in very localized infections. Nevertheless so many observers claim good results from vaccines that the text of the preceding pages appears out of respect for their views rather than because the author has faith in the measures advised. These pessimistic remarks deal with the vaccine treatment of infections already developed; and not with prophylaxis by vaccines to prevent typhoid fever and other fevers.

Rabies Vaccine.—Rabies vaccine is not a true vaccine, but is placed with the other vaccines because this name has been given to it. It is in reality an emulsion prepared from the spinal cord or brain of an animal infected with rabies. Probably the best vaccine to employ is that devised by Cumming. In the Cumming process the brain tissue is removed from a rabbit after four or five days following an injection of fixed virus. A 1 per cent suspension of this brain tissue is then dialyzed against running distilled water until the toxic portion of the virus is removed. The antigenic properties remain unimpaired. When this so-called rabies vaccine is used a series of daily injections for a period of fourteen or twenty-one days is employed.

The original vaccine of Pasteur is prepared from the spinal cord of a rabbit which, having been inoculated about eleven to twelve days before, has died of the disease. Part of the upper cord is dried and from a small piece of it an emulsion is made with salt solution, to which there may be added some glycerin and phenol as a preservative. Emulsions made from one-day cords are more powerful than when made from three- or four-day cords. No cord is used after ten days unless it has been, after drying carefully, preserved in glycerin, when it may be potent after twenty days. Emulsions made from the older cords are used first.

The number of injections which should be administered varies somewhat with the location and extent of the wound of entrance. It has been found that when the hands, feet or legs are infected the case is usually milder than when the bite or laceration takes place about the head or neck. In the latter instance the disease develops rapidly and is prone to be fulminant. In the milder cases 14 injections usually suffice; in the severer ones 21 injections had better be used.

The injections are given subcutaneously, a new area for injection being selected for each dose.

Without rabies vaccine the mortality of bitten persons ranges from 16 to 20 per cent. With it less than 2 per cent in face wounds and less than 0.5 of 1 per cent in wounds of the extremities. After rabies develops this so-called vaccine is impotent to prevent death. Its value is purely prophylactic.

Rabies vaccine appears on the market in packages of seven 2-cc. syringe containers with needle. Larger packages are not dispensed because the product must be kept on ice continually; the manufacturer ships subsequent packages at intervals of six days after the first shipment.

IMMUNOGENS.—Under the name *immunogens* a series of preparations closely related to vaccines are marketed, the underlying idea being that by a process of centrifugalization the antigens are separated from such bacteria as are usually used in the form of so-called vaccines. By this means the bodies of the bacteria are eliminated as well as a large part of their protein and toxin content. Immunogens might perhaps be compared to the active principle of a drug extracted by chemical processes. "Streptococcus immunogen" represents in each cc. the extract of 2000 million streptococci both hemolytic and non-hemolytic whereas "streptococcus immunogen combined" contains in addition Staphylococcus aureus and albus. When it is desired to use dead bacteria, that is, vaccines, for the purposes of protein therapy immunogens are useless because they have so small a protein content. The doses used vary from $\frac{1}{2}$ to 1 cc. given intramuscularly daily, or on every alternate day, and when they are employed a slight febrile reaction is usually looked forward to as an advantage.

VENESECTION.

Bleeding, or phlebotomy, is so rarely practised today that very many of the profession have never abstracted blood for therapeutic purposes or have even seen it done by someone else. Furthermore, it is to be feared that many of the younger physicians would hardly know how to bleed if called upon to do so at a crisis. All this is wrong, for bleeding is a measure undoubtedly of the greatest value, and one which every physician may be called upon to resort to. Like many therapeutic measures, it was sadly abused in the early part of the last century, and people when taken ill were bled with the same regularity that they were put to bed.

The indications for venesection are as clear and well defined as are the indications for any remedy. Briefly stated, it may be said that all states of the circulatory system denoting high arterial tension and acute excitement are indications, and that weakness, low arterial tension and systemic or circulatory depression are contraindications, but the chief indication is when there is great venous engorgement or turgescence.

In many cases of disease of the mitral valves with ruptured compensation and marked turgescence of the great veins, venesection gives great relief. This also holds true in pneumonia with venous turgescence and in uremia. Venesection is useless in intense capillary congestion due to marked toxemia, as in epidemic influenza.

In *eclampsia* and *sunstroke* with great cyanosis and venous engorgement, venesection may save life.

In *apoplexy* the extravasation of blood into the brain causes great arterial tension, and free venesection has been commonly performed to relieve this state. Recent studies by Cushing, however, indicate that bleeding under those conditions is contraindicated. (See Apoplexy, Part IV.)

The method by which venesection is practised is yet to be described. It is a very simple operation if an assistant is present to make pressure on the vein or entire arm. Often this pressure is best exercised by means of the cuff of a sphygmomanometer apparatus or a handkerchief or bandage tightly twisted about the arm above the spot where the wound is to be made. Under these circumstances the veins of the arm become prominent and distended. Many physicians bleed by pushing a large hollow needle or cannula through the skin into the distended vein toward the hand. If, however, the veins are small or buried in fat one of them may be readily bared by a short longitudinal incision of ½ inch, the fascia being separated until the glistening blue surface of the vessel appears free from fat or connective tissue. Into this vessel, with the edge of the knife turned upward, a small longitudinal incision is made, care being taken that the point of the blade is not driven in far enough to injure the distal wall of the vein, or a sharp-pointed pair of scissors is used and the vessel is snipped on its anterior wall. If a clot forms and stops the flow, it must be removed by a piece of aseptic gauze, while if the flow is to be stopped, remove the bandage above and apply a compress over the incised vein, the compress being held in position by a bandage. Care should always be taken that the bandage on the upper part of the arm is not so tight as to cut off all blood supply to the arteries of the lower part of the limb.

Many years ago Lauder Brunton pointed out that if there is not a free flow of blood, due to the fact that it seems too viscid, the use of oxygen by inhalation will make the flow more freely.

The amount of blood to be removed varies with the size of the patient, the degree of plethora and the effects desired. As a rule, 8 ounces to 1 pint are taken from a vigorous adult. Children should rarely be bled, and it is not to be forgotten that bleeding robs the patient of a fluid or tissue which is vital and not speedily replaced, particularly in those who are ill.

VITAMINES.

Vitamines are substances found in comparatively minute amounts in many different forms of foodstuffs. If by some natural or artificial process these foodstuffs are deprived of their vitamines they still possess nutritive value, but this value is akin to the value of gasoline in an automobile which has no electric spark to ignite it. This simile also emphasizes the fact that vitamines have no nutritive value in the sense that they provide energy or tissue to the body.

Our knowledge of vitamines is still limited. As with antitoxin so with vitamines, no one has ever seen them, or isolated them chemically, and we still are ignorant as to how many forms there are. It has been well proved, however, that there are at least five and probably six, and that each of them performs a definite function in the body, so that if it is lacking in the food for any length of time certain definite and even dangerous alterations in nutritional processes ensue.

Although the vitamine content of a given foodstuff cannot be determined by chemical analysis, its activity as to vitamines is arrived at by biological assay.

The recognized vitamines are as follows: A, a fat-soluble vitamine; it aids growth and if absent from the diet there results a susceptibility to infection. There is great dryness of the mouth through faulty function of the salivary glands. B, a water-soluble vitamine, which governs nutrition in such a manner that its absence results in malnutrition, polyneuritis or beriberi. But McCollum believes that water-soluble B vitamine is really divisible into two vitamines one of which B1 vitamine prevents or cures polyneuritis, and the other called B2 vitamine prevents or cures pellagra,[1] and aids growth. C, a water-soluble vitamine governing nutrition in such a manner that if the individual is deprived of it scurvy ensues. D vitamine governs the calcification of the bones and if given in rickets cures that state. A, B, and D, are necessary for growth in children. Vitamine E, fat-soluble, is possibly the least important clinically, McCollum thinking that it influences advantageously the growth of the fetus and possibly prevents sterility.

The proportion of the vitamines in various foodstuffs varies greatly. Thus, raw milk contains A, B and C. A vitamine exists chiefly in "cod-liver and other animal oils, in egg-yolk, spinach, yellow corn, sweet potatoes, oranges and carrots. B vitamine is present in yeast, about the seed of certain plants and in certain ordinary vegetables. C vitamine is to be found in citrus fruits, as oranges and lemons, and in tomatoes and cabbage. Cod-liver oil and egg-yolk are rich in vitamine D. All of the vitamines may be destroyed by cooking, or certain mechanical means, as polishing rice. Water-soluble vitamine C is the one most readily destroyed by heat.

Illustrative of the result of vitamine deprivation we have the once prevalent scurvy of the crews of sailing ships, who had to live for months on preserved foods, and the incidence of scurvy today in babies fed on cooked milk or patented foods. Also the development of polyneuritis or beriberi, on land or sea, from the constant use of polished rice. It is interesting to note that in many decades lemon or lime juice was taken to sea to prevent scurvy, with the idea that the citric acid was the effective agent. Another instance in which the clinical observation was correct but the explanation erroneous.

It is obvious that in the presence of any of the disorders of nutrition the lack of vitamines must be considered as a factor, and one of the most remarkable instances of instinctive craving for a needed substance is seen in the case of the bottle-fed baby suffering from scorbutus, who will quickly grasp a spoonful of orange juice, tomato juice or beef juice once it has had chance to taste it.

When for any reason the natural sources of vitamines are difficult to obtain, or difficult to administer, the vitamines A, B and C may be prescribed in capsule form under the name "Metagen."

IRRADIATED ERGOSTEROL.—Sterol may be obtained from many sources although most of it is derived from yeast. When exposed to ultra-violet light it contains a considerable amount of vitamine D and becomes a very potent agent in influencing the utilization of calcium in the living body of man and animals, and the content of inorganic phosphorus in the blood which in rickets is constantly below normal, whereas that of calcium may not be reduced. The exact sphere of usefulness of irradiated ergosterol is still uncertain aside from its remarkable influence in *rickets* in which condition, to use the words of Hess, it causes a "precipitate calcification of the cranial bones." It is probably indicated in cases of *spasmophilia*, certain types of *tetany* and in instances of *osteomalacia.*

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[1] B1 is sometimes called vitamine F and B2 vitamine G.

For clinical purposes irradiated ergosterol is dissolved in some neutral vegetable oil and is given the name Viosterol. If for any reason cod-liver oil cannot be employed viosterol, which contains one hundred times the antirachitic power of cod-liver oil, is given in doses varying from 8 to 10 drops three times a day as a preventive of rickets, and 15 to 20 drops three times a day for curative purposes. By "drops" is meant the third of a minim.

It is not to be forgotten that irradiated ergosterol is a very potent agent and too large doses may be definitely harmful or even dangerous as it is capable of producing a hypercalcemia and a phosphatemia.

FEEDING THE SICK.

In the opening pages of this work the importance of properly feeding the sick has already been emphasized. Water is to be kept in mind as an absolute necessity to the body, even greater than food. It ought to be given freely particularly in fevers like typhoid and when sweating or urination is excessive, but the order commonly given to the nurse "push water" often results in overwhelming the body with liquid. It is manifestly impossible for the writer to go into details concerning the deep and difficult problems of the changes in the food when taken into the body for assimilation. At this point it is necessary only to recall that the foods taken by man consist in proteins, carbohydrates and hydrocarbons. In the albuminous or protein articles of food nitrogen is a prominent constituent, and the type is egg-albumen. While most nitrogenous foods are animal in source, it must not be forgotten that gluten and legumin are nitrogenous and derived from vegetables. The carbohydrates consist of substances in which carbon, hydrogen and oxygen are combined, the hydrogen and and the oxygen in the proportion to form water, of which the types are starch, dextrin, cane-sugar, grape-sugar, lactose or milk-sugar. The hydrocarbons are composed of carbon, hydrogen and oxygen, but the proportion of oxygen is insufficient to convert all the hydrogen into water. The types of this group are butter and other fats.

The function of the protein, or albuminous, foods is to contribute to the repair and formation of the body tissues, particularly those which are nitrogenous; they also contribute to the development of muscular and nervous energy and the production of heat, being split up into nitrogenous and non-nitrogenous parts, from the last of which fat may be formed and deposited or burnt up in the development of force.

The carbohydrates are split up in the body into carbonic acid and water, and in this process yield heat and energy. Unlike the proteins, they do not enter the tissues of the body unless it be that they are converted into fat. By reason of the heat and energy which they contribute to the economy they protect the albumens and fats from demands which would otherwise be made upon them for these purposes. They are essential for the proper utilization of fats, for the fats burn in the fire of the carbohydrates.

In considering this subject scientifically there are several facts to be understood. Starch, and dextrin the first step in starch digestion, are polysaccharides and as such are not utilizable until by the action of enzymes they are converted first into a disaccharide such as maltose and then one step further by enzymes in the digestive tube, or in the blood, into a monosaccharide dextrose. When cane-sugar, a disaccharide, is taken it is inverted into two monosaccharides, dextrose and fructose, and if milk-sugar or lactose, also a dissaccharide, is ingested it must be split by acids or enzymes into the monosaccharides glucose and galactose. Therefore the use of maltose, cane-sugar or milk-sugar is equivalent to employing starch already partly changed to a form in which it can be used by the body, but it has been proved that the body of a child finds it twice as easy to take up maltose as to assimilate either lactose or cane-sugar, although all these are disaccharides. The very readiness with which maltose is taken up is on the one hand advantageous and on the other disadvantageous. Little difficulty is experienced in its assimilation, but the very readiness of its absorption tends to flood the body with it before it can be changed into glucose and utilized or stored. Commercial maltose containing dextrin is therefore not to be condemned because of the presence of the dextrin for it retards maltose absorption to some extent and, as it has to be changed into a monosaccharide, it is taken up slowly and acts as an adjuvant to maltose. It is as if a predigested food were taken before bread, thereby giving immediate energy, to be followed by a gradual supply from the slowly converted bread to maintain energy. The readily obtained energy from the maltose also provides energy to aid the body in converting the dextrin into maltose. Finally the starch present is changed to maltose so that the stomach receives one feeding but the tissues three feedings as conversion and assimilation go on.

The hydrocarbons, or fats, are also employed in the body to yield force and heat, and by their use the albuminous portions of the body are protected. For these reasons hydrocarbons and carbohydrates can be well taken in large quantities by those who take much exercise, but are harmful if partaken in excess by persons leading sedentary lives.

It is manifest, therefore, that for the maintenance of health we must provide a patient, not with nitrogenous or carbohydrate foods alone, but with some of all the food articles, regulating the proportions of each to his needs and his ability to utilize them after they are ingested. The practical application of these facts is as follows:

In fevers, in which there is an active wasting of the tissues of the body, we give albuminous foods to replace the tissues destroyed or to make up for their loss, and these consist of soups, eggs, milk, and the gelatinous substances which, while not very nutritive, are what are known as "albumin-sparing" substances. As the secretion of the gastric juice is faulty in nearly all fevers, it is important to give these foods in semi-liquid or liquid form, so that they can be readily digested, and we often aid their digestion by the use of pepsin and hydrochloric acid.

As carbohydrates and hydrocarbons add heat or energy to the body, and their combustion protects the albuminous tissues, they also must be used, particularly the former. There is no doubt that physicians are far too prone to limit the patient's diet during fevers to proteins, and in the author's practice he invariably prescribes, in addition to the protein foods, thin preparations of starch, such as strained rice, strained oatmeal, cracked wheat, corn-starch, and barley, aiding their digestion, if need be, with taka-diastase or pancreatin.

In order that an approximate idea of the proportion of foodstuffs may be conveyed to the reader, it may be pointed out that the adult human body when at full activity must be provided in twenty-four hours with that amount of food which will yield his body 3000 to 3500 Calories,[1] or to express it differently he needs about 40 to 50 Calories for kilogram (2.2 pounds) of body weight. This is best accomplished by the use of the following proportions: Carbohydrates, 400 grams; fats, 125 grams; proteins, 125 grams equalling 3225 (Atwater), calculating 4 Calories to the gram of carbohydrate, 9 Calories to the gram of fat and 4 to the gram of protein. Nearly all foodstuffs contain the several classes of proteins, carbohydrates and hydrocarbons in varying proportions. It is interesting to note how many more calories are provided per gram by the fats than by the proteins and starches, but it is also worthy of note that the proteins provide the materials which are useful for the repair and growth of tissues and the production of energy.

The common foods may be measured approximately as follows:

	Grams.	Calories.
1 tablespoonful of oatmeal, equals	40	34
1 medium-sized white potato, equals	90	90
1 slice of bread ½ inch 5 x 5, equals	25	80
1 roll, equals	30	115
1 large tablespoonful of rice, equals	30	45
1 tablespoonful of macaroni, equals	35	25
1 tablespoonful of cooked peas, equals	30	40
1 tablespoonful of sugar, equals	8	33
1 medium-sized oyster, equals	15	8
1 orange (small), equals	150	60
1 egg, equals	50	78
1 pat or ball of butter, equals	8	80
1 slice lean roast beef ¼ inch 5 x 3, equals	60	70
1 wineglass of whisky, equals	30	85

As pointed out, the normal intake when an adult man is active is about 3200 Calories, and the nutritional balance is approximately maintained by 400 grams of carbohydrate, 125 grams of fat and 125 grams of protein. The approximate amounts of foods needed in health can be calculated from this table:

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[1] A Calorie is the French unit of heat, or that amount of heat required to raise the temperature of one kilogram of water one degree Centigrade.

Thus a breakfast of:

	Calories.	Approximate carbohydrate. Grams.	Approximate protein. Grams.	Approximate fat. Grams.
6 tablespoonfuls of oatmeal, equals	210	48	7	
1 glass of milk, equals	160	12	7	
2 eggs, equals	140	..	13	5
2 pats of butter, equals	160	..	..	16
2 slices of bread	160	26		
2 teaspoonfuls of sugar, equals	66	16		
	896 Calories.			

The other meals can easily be figured in the same manner. When a patient is at rest in bed and not suffering from a fever or its results or other wasting disease, 2000 Calories is usually quite ample. It is to be recalled, however, that no individual needs on every day the fixed proportions of foodstuffs named. He can get along with far less protein in many instances, particularly if he increases his carbohydrates and fats.

A strict milk diet is impossible without starvation because to get 3000 calories the patient would have to take between 4 and 5 quarts a day. This would overburden his stomach and kidneys and, while giving 3000 Calories, would contain an excess of protein and fat and an inadequate amount of carbohydrate. As this amount cannot be taken the patient must be some extent live on himself. If he attempts this excess of milk and his kidneys are diseased he is unable to get rid of such an excess of liquid and will become dropsical unless freely purged.

Water forms such an important part of the body that its free ingestion is advisable, if it is pure, in nearly all cases of disease except acute or advanced parenchymatous nephritis.

Having considered the general theory of feeding, we may now proceed to the actual preparation of food for the sick. There are several important general facts to be borne in mind in this connection:

1. The food, when prepared, must be capable of ready assimilation.
2. It must be, as a rule, fairly concentrated in the sense of containing great nutritive power in little bulk, since it is a mistake to weary a feeble patient with much swallowing.
3. It must be easily swallowed.
4. It must be as attractive to the sight, smell, and taste as possible. When milk is given for any length of time its taste should be varied, if possible, by the addition of enough coffee, tea, cocoa, or sweetening to prevent the patient from taking a dislike to it. Its nutritive properties may often be advantageously increased by the addition of some of the well-known infant foods; and if it curdles too quickly in the stomach, this may be delayed by the use of barley-water in equal parts, or by the addition of thin oatmeal gruel or strained rice, or sodium citrate. (See Part II.) Often the addition of salt improves the taste and aids its digestion, and its dilution by adding aërated or

carbonated water from a syphon is also refreshing and aids digestion in some instances. In other instances the best results are produced by peptonizing the milk (see below). When broths are used, they may well be flavored with other things than the meat from which they are made. This is easily accomplished by placing in a small bag such vegetables as carrot, turnip, celery, parsnip, parsley, thyme, etc., and then cooking this bag and its contents with the broth, whereby the nutritive properties of the meat and vegetables and the flavoring of the latter are given to the soup. (See Diabetes, Part IV for diets.)

INFANT FEEDING.

Many methods and formulæ have been devised for the feeding of premature, sick and healthy infants that cannot be nourished at the breast for various reasons. A number of such recipes or formulæ are appended, but in general terms it is to be borne in mind that the simplest plan is obviously the best and this simple plan will suit nearly every type of case. It is the use of cow's milk, properly protected as to its source and storage, diluted with boiled water and fortified by the addition to it of some form of carbohydrate. The addition of water dilutes the excess of protein and of salts to a point equivalent with breast milk and the resulting dilution of the fats is compensated by added carbohydrate which is an advantage in that the inability of many infants to deal with fats is removed. It is important to recall that an infant requires more food in proportion to its weight than an adult and an emaciated infant more than one which is well nourished. In general terms the diet may consist of 1½ ounces of milk and an equal quantity of water with 1 dram of carbohydrate per pound of body weight. Thus, if the infant weighs 10 pounds it would receive 15 ounces of whole milk, 15 of water and 10 drams of carbohydrate. It may be considered that the caloric requirement is about 50 Calories per pound and the above proportions will give of the milk 300 Calories, of the carbohydrate 160 Calories, a total of 460 Calories, a little less than the theoretical 500 on the basis of 50 Calories per pound. These 30 ounces should be given in seven feedings in twenty-four hours. Exact figuring is not possible because of the variations in the quality of the milk. Very high grade milk needs dilution with more water. Probably the best carbohydrate to employ is dextro-maltose or ordinary corn syrup (Karo). Milk sugar may be given in some instances. If the infant is premature it is usually best to use skimmed milk, thereby getting rid of an excess of fat for its weak digestion, and adding carbohydrate in increased amount to compensate in calories for the loss of fats. As the infant increases in size and age the quantity of fluid is relatively decreased, for the greater the weight the less the fluid proportionately.

If the bottle-fed infant "spits up" excessively, has much colic, or passes greasy stools, or if the urine is ammoniacal, it is usually wise to cut down the fat intake by using skimmed milk.

The following recipes will be found useful in many cases:

BUTTER–FLOUR MIXTURE FOR INFANTS.

This mixture has been found very useful for the feeding of infants suffering from severe malnutrition and even in premature infants, particularly if they fail to do well on different milk formulas. It has a very high calorie value.

Heat 3 tablespoonfuls of butter in a sauce-pan over a slow fire until foaming ceases. Add 2½ ounces of wheat flour and continue heating with constant stirring for four or five minutes, until the mixture becomes thick and turns brown. Add 20 ounces of warm water and 2 tablespoonfuls of granulated sugar and cook for twenty minutes. Strain through a fine sieve and add about 10 ounces of milk. Decant in several bottles, cool and keep on ice until ready to use. As each ounce represents about 25 Calories, an infant weighing 10 pounds should receive about 20 ounces of the mixture per day with additional water from time to time. Its use is contraindicated in patients with a tendency to diarrhea.

CASEIN MILK.

This preparation is useful in feeding adults and infants with very feeble or disordered digestion. To 1 quart of fresh milk at 100° F. add 4 teaspoonfuls of essence of pepsin and mix thoroughly. After this mixture has stood at 100° F. until it has become curdled (this usually occurs in about thirty minutes), filter off the whey through a clean linen handkerchief and allow the curd in the handkerchief to remain suspended until the whey ceases to drop from it. The curd is then placed on a fine sieve, through which it is pressed by means of a knife-blade or spoon. Add to this curd, which has been finely divided by passing through the sieve, 1 pint of water and 1 pint of buttermilk, which should be less than twenty-four hours old. This preparation is practically a form of predigested milk and the individual curds are so fine as to be easily digested. Depending upon the richness of the milk, 1 quart of this preparation contains a little less than 400 Calories, and equals about 3 per cent of protein, 2.5 per cent of fat, 1.5 of sugar and 0.5 per cent of salts. When used in cholera infantum the quantities administered should, at first, be very small and gradually increased until the stomach and bowels become tolerant.

EVAPORATED MILK.

Evaporated milk, unsweetened, has been found to be an excellent food for infants at all ages, It is sterile, easily digested and of uniform composition, all of which factors are not to be found in fresh milk or pasteurized milk. Furthermore, the process of evaporation does not impair the vitamine content except in so far as vitamine C is concerned. Dried milk which has been irradiated by ultra-violet light is particularly useful in children suffering from rickets.

PROTEIN MILK.

Another formula designed for infants suffering from fermentative diarrhea closely resembles the last preparation and is recommended by Stewart:

1. Boil 1 quart of whole cow's milk for two minutes and let cool to room temperature.
2. Add 1 teaspoonful of chemically pure lactic acid and let stand a few minutes.
3. Strain the curdled milk through a cloth thoroughly.
4. Add the curd so obtained to 1 pint of buttermilk and stir actively with an egg beater. If sterilized food is needed boil the product after adding 1 teaspoonful of flour to each pint.
5. Add sterile water to make up 1 quart.
6. If desired add dextri-maltose to the extent of 3 to 5 per cent.
7. Feed from nursing bottle with large hole in rubber nipple.

BUTTERMILK AND STARCH.

Take 1 quart of fresh buttermilk, and add it gradually to 1 or 2 tablespoonfuls of rice flour or wheat flour, stirring constantly so as to prevent the formation of lumps. This mixture is now heated slowly for a period of fifteen or twenty minutes, until it reaches the boiling-point, when it is taken from the fire and from 1 to 2 ounces of sugar are added. It is then placed in a bottle which is corked and placed on ice, where it may be preserved for a considerable period of time. By the use of sugar the deficiency in heat units caused by the abstraction of the butter fat is compensated, and the addition of the rice flour not only increases the heat units but also prevents the formation of tough curds. Such a preparation, after standing, separates into two layers, the upper one being composed of the milk serum, and the lower one, containing the coagulated casein in very fine curds, which are, therefore, ready for digestion. The bottle should be shaken to mix these two layers before its contents are used. Such a preparation may be given to infants in the proportion of 3 to 6 ounces for each 3 pounds of the child's body weight per day. Where gastro-intestinal disturbance already exists with a passage of undigested curds, the buttermilk should be preceded for one or two days by beef juice or rice water, and then given in gradually increasing quantities. This form of buttermilk may also be given to invalid adults as a concentrated, easily digested food. (See article on Malt Soup.)

As much of the buttermilk which is found on the market is not fresh, it is often best to prepare it by the use of "Lactone Tablets," which contain lactic acid bacilli. The advantage of buttermilk prepared by this means is that it contains all its butter-fats, and, therefore, has a higher nutritive value than ordinary commercial buttermilk. It is essential, however, that the milk shall be fresh and that no preservatives, such as formaldehyde, shall have been used, since such preservatives prevent the lactic acid bacillus in the tablets from acting upon the casein.

The method of employing lactone tablets is as follows:

To 1 quart of fresh milk add 1 lactone tablet, shaking or stirring the fluid so that the crumbled tablet will be thoroughly dissolved. After being properly covered the bottle containing the milk should stand at the ordinary room temperature of from 70 to 80° F. for from twelve to twenty-four hours. The warmer the air the shorter the time necessary for the change to take place. The bottle containing the milk is than placed in a refrigerator for future use. After standing for some time it separates into two layers which should be thoroughly stirred until a homogeneous fluid is produced before it is used.

When buttermilk is used not only as a form of food, but also for the purpose of getting the effect of the lactic acid bacillus as a therapeutic agent, it must be taken when it is not more than twenty-four hours old, so as to avoid excessive acidity and in order to obtain active bacilli. (See Lactic Acid Bacillus, Part II.)

MILK, FLOUR AND MALT.

For an infant suffering from hard stools with putrefactive odor and an ammoniacal urine.

Rub up 4 teaspoonfuls of baked flour with a little milk to form a paste. Add more milk with constant stirring up to 12 ounces and strain through a sterile sieve. In another container put 2 teaspoonfuls of extract of malt and dissolve in 24 ounces of warm water, adding 20 grams of bicarbonate of sodium. Mix the two fluids and, with constant stirring, heat slowly until the mixture has boiled for two minutes.

MALT SOUP.

Malt soup is a useful food in infants who are suffering from enterocolitis or general emaciation and in those with imperfect digestion of the fats. This is easily prepared by using Mead's Dry Malt Soup which contains maltose and dextrin, 47 per cent; wheat flour, 47 per cent; potassium carbonate, 1 per cent, and moisture 5 per cent. For babies under three months of age the following formula may be used.

Whole milk	7 to 10 ounces
Boiled water	14 to 20 ounces
Dry malt soup stock	2 rounded tablespoonfuls.

For children over three months:

Whole milk	12 to 24 ounces
Boiled water	12 to 24 ounces
Dry malt soup stock	2 to 4 rounded tablespoonfuls.

In either case mix enough of the milk and water with the dry soup stock to make a thin paste. Add the balance and boil for fifteen minutes with careful stirring. Do not use a double boiler. For children under three months feed 2 to 3 ounces every two hours. For children over three months feed 4 to 8 ounces according to age and weight every three or four hours.

Resort may also be had to the so-called corn-syrup commonly sold, as it contains about 55 per cent of dextrin, 30 per cent of maltose and 15 per cent of dextrose. As it is too thick to mix readily with milk it may be diluted half with water, 3 per cent of corn-syrup or 6 per cent of the diluted syrup being added to the milk and gradually increased if nutrition is impaired and no diarrhea ensues.

Malt soup may be also made from the Extract of Malt official in the U. S. P., or by using the Malt Soup Extract made by the Maltine Company. The ingredients in the preparation are varied to the needs of the individual, but a standard formula may be prepared as follows:

Mixture No. 1.

Malt soup extract	2½ fluidounces
Sterile warm water	22 fluidounces

Thoroughly dissolve.

Mixture No. 2.

Wheat flour	2½ ounces
Fresh milk	11 fluidounces

Mix thoroughly and strain through a fine sieve.

These mixtures are now mixed together thoroughly and are boiled for three minutes with constant stirring. After rapid cooling pour into sterile feeding bottles and store in a cool place, the bottles being plugged with sterile cotton.

This mixture has a value of about 696 Calories and as it is generally recognized that an infant requires approximately 45 Calories to the pound in twenty-four hours the quantity of this malt soup and its dilution required by the child may be estimated with fair accuracy.

LACTIC ACID MILK.

This preparation of cow's milk has been found singularly efficacious as a food for infants of all ages, having been introduced by Marriott and Davison. It is usually given at three hour intervals, the last feeding being at 10 o'clock at night, when further feeding is not necessary until the following morning. Colic rarely occurs and there is usually neither constipation nor diarrhea. There is often a notable gain in weight.

It is based upon the theory that all milk holds a buffer substance capable of uniting with acid or alkali. Breast milk contains a very small amount of buffer substance, but cow's milk holds large amounts and is, therefore, capable of neutralizing the hydrochloric acid in the stomach.

The intent of lactic acid milk feeding is to acidify the cow's milk, or, in other words to overcome the effect of the buffer substance. To add to the carbohydrate content, some form of sugar which is easily assimilated is added, and it has been found that ordinary karo syrup or corn syrup is efficient. By this method, feeding whole cow's milk to children at all ages can be practised, so that different formulas for different ages are not essentail.

This preparation is as follow: To each pint of good grade cow's milk, add 2 tablespoonfuls of karo corn syrup and thoroughly mix. Gently boil the milk for five minutes. Then stand in a cool place until thoroughly cooled, or place in the ice-box over night. By means of a medicine dropper, add 1 teaspoonful of chemically pure lactic acid, 85 per cent, drop by drop, to each pint, gently stirring the mixture, and keep in a cool place until it is to be used, when the bottle containing it is to be gently warmed and shaken.

Probably largely because of its caloric content the formula is particularly useful in feeble, poorly nourished or premature infants.

DEXTROSE MILK.

As dextrose (see Part II) is almost at once utilizable in the body and as cow's milk lacks carbohydrate, it is often wise in the case of bottle-fed babies to use formulas about as follows. Thus a child two months of age weighing 10 pounds may have a mixture of 15 ounces of cow's milk with 11 ounces of boiled water in which is dissolved 4 level tablespoonfuls of dextrose. Four ounces of this is fed every four hours. A child of five months weighing 12 to 14 pounds should have a mixture of 22 ounces of milk, 8 of boiled water, 5 level tablespoonfuls of dextrose and be fed 6 ounces every five hours. After the eighth month of life when the milk may be as 30 ounces with water 14 ounces, the quantity of dextrose is gradually decreased until at one year of age no dextrose is added. When dextrose is not obtainable Karo syrup may be employed in its place in about the same proportions.

WHOLE MILK FEEDING FOR INFANTS.

In cases in which it is difficult or impossible to arrange for percentage feeding of infants, whole milk feeding is resorted to. It is rarely begun before the end of the first month of life. If it is needed earlier, the milk is to be diluted with water one-half. At first 2 grains of sodium citrate to each ounce of milk is used and later 1 grain. Infants often thrive remarkably well on this plan. (See Sodium Citrate.)

PEPTONIZED MILK.

Take a perfectly clean, clear glass quart bottle and place in it the contents of 1 tube of Parke, Davis & Co.'s peptonizing powder, or the contents of 1 of Fairchild's peptonizing tubes, and 1 teacupful of cold water, and after shaking pour into the bottle 1 pint of perfectly fresh cool milk and stir the mixture thoroughly. Next place the bottle containing the milk in a can of water at such a temperature that the whole hand may be submerged in it without pain. If complete digestion of the milk is desired this application of heat may be continued as long as twenty minutes, but in most cases five minutes are sufficient. If carried on longer than five minutes the milk will become bitter and disagreeable to the taste through the development of peptone in excess.

Immediately after taking the bottle from the hot water it should be placed on ice, in order to check further peptonizing and to keep the milk from spoiling; or if ice is not available the water-bath should be quickly brought to a boil in order to prevent further action of the ferment, and the bottle corked and then be put in a cool place. This recipe may be used where it is thought necessary to digest the milk before it is swallowed. Where we desire simply to aid digestion it is best to follow the directions already given, except that the bottle is not heated, but at once placed upon ice and allowed to remain there, being slightly warmed when it is desired to give it to a child, or it may be given as a cool and refreshing drink to an adult, the heat of the body rapidly causing the ferment to do its work as soon as the food enters the stomach. When irritability of the stomach exists in adults, this peptonized milk may be made more agreeable to the taste by following the directions given in the first recipe, except that it must remain in the hot water for no less than two hours, when it is poured out into a tin cup or pan and rapidly brought to the boiling-point. After this it is strained through a piece of coarse muslin and placed upon ice. Before giving it to a patient this mixture may be flavored with lemon- or orange-juice or any form of acid that is desired, without the milk becoming curdled. *Peptonized milk-punch* is made from milk prepared in the way already described in the first recipe by adding St. Croix or Jamaica rum or brandy, and is a pleasant nutrient, particularly if the surface of the liquid is sprinkled with a little grated nutmeg.

A very refreshing and agreeable drink may be made by diluting peptonized milk one-half with highly charged carbonic-acid water, and swallowing it while effervescing.

SOYA BEAN FLOUR FOR INFANT FEEDING.

Ruhräh has highly recommended the use of soya bean flour for children for whom fresh milk cannot be obtained, or when it is of questionable quality; or, again, when cow's milk, even when properly diluted, disagrees with the patient, as shown by vomiting or diarrhea. This flour is always used in conjunction with barley flour as follows:

One level tablespoonful of soya flour, 2 level tablespoonfuls of barley flour, a pinch of salt, and 1 quart of water are mixed and boiled for at least twenty minutes. Afterward fluid lost in boiling is replaced by pure water. To this mixture is added condensed milk in proportions varying from 1 to 16 to 1 to 8, according to the age of the child and the digestive state. From 2 to 8 ounces are used at a feeding every three hours. In older children the amount of soya flour and barley flour may be doubled, but if too much soya flour is used the stools become foul, watery, and dark colored. This is also prone to occur if barley flour is not employed, even if the amount of soya flour be proper.

PEPTONIZED BEEF OR OYSTERS.

The following method of preparing peptonized beef is recommended by the Fairchilds, and is very useful, as is also peptonized oyster stew, as first introduced by the late Dr. N. A. Randolph.

Take $\frac{1}{4}$ pound of finely minced raw *lean* beef; cold water, $\frac{1}{2}$ pint. Mix in a saucepan. Cook over a gentle fire, stirring constantly until it has boiled a few minutes. Then pour off the liquor for future use, beat or rub the meat to a paste, and put it into a clean fruit-jar with $\frac{1}{2}$ pint of cold water and the liquor poured from the meat, and add

Extracti pancreatis	20 grains (1.3)
Sodii bicarb.	15 grains (1.0)

Shake well together, and set aside in a warm place, at about 110° to 115° F., for three hours, stirring or shaking occasionally; *then boil quickly*. The liquid may then be strained or clarified with white of egg in the usual manner, and seasoned to taste with salt and pepper.

In the great majority of cases it is not necessary to strain the peptonized liquor, for the portion of meat remaining undissolved will have been so softened and acted upon by the pancreatic extract that it will be in very fine particles and diffused in an almost impalpable condition, and is therefore in a form ready for assimilation in the body.

Peptonized Oysters.—Peptonized oysters are prepared by mincing six to twelve large oysters, and adding to them, when mixed with a moderate amount of their own liquid, 5 grains (0.3) of pancreatin or peptonizing powder and 20 grains (1.3) of sodium bicarbonate. The cup containing this mixture is now placed in water at 100° F., and allowed to remain there from ten to twenty minutes, according to the degree of digestion desired. After this the liquid mass is quickly brought to a boil to cook the oysters and stop digestion, and served with pepper and salt as required. Any condiment or flavoring substance may be used.

PEPTONIZED ENEMATA.

Comparatively recent investigations have proved conclusively that so-called nutrient enemata aid very little in maintaining nutrition, most of the benefit being due to the fact that the fluid part of the injection is absorbed but the solids remain in the bowel.

A nutrient enema which has been much used may be prepared by following the directions given above for peptonizing milk, except that an egg, yolk and white, should be beaten up in the milk before the ferment is added. The effect of this enema may be increased by the addition of 1 teaspoonful to 1 ounce of whisky or wine. This should be warm when injected into the rectum.

The rectum is apt to become irritable if injections are given frequently, and particularly if the same mixture is repeated a number of times. This can be avoided by resorting to the "drop method" of Murphy and the Fowler posture. (See Peritonitis.) It is often well to substitute for the formula just given the following recipes:

Von Leube recommends 5 ounces of scraped meat, chopped very fine, and to this are added 1½ ounces of finely chopped pancreas; the whole is suspended in 3 ounces of lukewarm water, and stirred to the consistence of a thick pulp. This makes one injection. Pancreatin or peptonizing tablets can be as well used as the pancreas itself.

Rennie's formula consists of ½ pound of lean meat pulled into shreds and added to 1 pint of beef-tea; to this are added 1 dram of fresh pepsin and ½ dram of dilute hydrochloric acid; the mixture is kept at a temperature of 99° F. for four hours, during which it is stirred constantly. If too great heat be employed, the digestive process will stop.

An enema which Bidwell employs is made as follows: milk, 2 ounces; strong beef-tea, 2 ounces; yolk of egg, 1; pancreatic solution, 1 dram. This is to be prepared one hour before use, and to be kept at a temperature of 100° F.; ½ to 1 ounce of brandy is added, when necessary, immediately before use.

Greig Smith uses 1 egg beaten up in 6 ounces of milk with 2 or 3 teaspoonfuls of meat-jelly, or peptones may be added. This is administered warm with or without ½ ounce of brandy every five or six hours.

DIGESTED GRUEL.

Digested gruel may be made by taking thoroughly boiled hot gruel made from oatmeal, barley, wheat, or from arrowroot, to the amount of ½ pint (240 cc.), and adding thereto, while it is hot, ½ pint (240 cc.) of fresh, cold milk; to this may now be added the contents of one peptonizing tablet or tube, and the mixture allowed to stand in moderately hot water or in a warm place for twenty minutes before it is placed upon ice. Ten grains (0.65) of taka-diastase may be used in place of pancreatin. The mixture must not be hot enough to kill the digestive ferment.

KOUMYSS.

This preparation of milk which is very useful for children and adults during convalescence from acute or subacute exhausting diseases. Even children of three or four years will acquire a liking for it if it is not made too sour by continuing the fermentation process too long. The liquid is prepared as follows: Add to 1 pint (480 cc.) of cool, perfectly fresh milk 2 teaspoonfuls (8.0) of sugar, and place it, after shaking thoroughly, in a clean beer or claret bottle. Then add ⅙ of a cake of Fleischman's compressed Vienna yeast, and tightly cork the bottle, standing it in a warm place or in a water-bath at 99° to 100° F. for eight to ten hours. Then place in a cool place or on ice and use as needed. It must be remembered that the development of carbonic gas is very great in this liquid, and that if an ordinary cork is inserted it must be tied in before the heat is applied. Further than this, the cork must be pulled very gently or the liquid will spurt all over the room. The best thing to use when about to open a bottle of koumyss is a "champagne tap," by means of which the liquid may be drawn off as needed.

BEEF-TEA.

Take 1 pound of lean beef and mince it. Put it with its juice into an *earthen vessel* containing a pint of *tepid water,* and let the whole stand for one hour; strain well, squeezing all the juice from the meat. Place on a fire, and slowly raise *just to the boiling-point, stirring briskly* all the time. Season with salt and pepper to taste. In administering this always be careful to stir up the sediment.

Or, take 2 pounds of beef without fat or bone, and ½ breakfastcupful of cold water; place in a jar in a saucepan of water; simmer four hours.

RESTORATIVE BEEF-ESSENCE (RINGER).

Take 1 pound of fresh beef free from fat, chop it fine, and pour over it 8 ounces of soft water, add 5 or 6 drops of hydrochloric acid and 50 or 60 grains of common salt; stir it well, and leave for three hours in a cool place. Then pass the fluid through a hair sieve, pressing the meat slightly, and adding gradually toward the end of the straining about 2 ounces more of water. The liquid thus obtained is of a red color, and possesses the taste of soup. It should be taken cold, a teacupful at a time. If preferred warm, it must not be put on the fire, but heated in a covered vessel placed in hot water.

Should it be undesirable for the patient to take the acid, this soup may be made by merely soaking the minced beef in distilled water. Or, take 1 pound of beef free from fat and skin, chop it very fine, add a little salt, and put it into an earthen jar with a lid, such as is used for roasting venison; seal the edges with a thick paste, and place the jar in an oven for three or four hours; strain through a coarse sieve. Give the patient two or three teaspoonfuls at a time. Or, cut in small pieces 1 pound of lean beef from the sirloin or rump, and place it in a covered saucepan, with ½ pint of cold water, by the side of a fire for four or five hours; then allow it to simmer gently for two hours, skim well, and serve.

BARLEY-WATER.

To prepare barley-water, put 2 good-sized teaspoonfuls of washed pearl barley with 1 pint of cold water in a saucepan, and boil slowly down to two-thirds. Strain.

Barley-water for Adults.

Take of finest barley ¼ pound; to this add 1 quart of water and boil to 1 pint; strain and add 1 quart of boiled milk. To this add 6 ounces each of brandy and lime-water; sweeten to taste; flavor with nutmeg and rind of lemon rubbed with sugar. This forms a most nourishing and palatable drink when kept cold on ice.

OATMEAL-WATER.

Add 1 tablespoonful of oatmeal-flour to 1 pint of water and boil down to two-thirds of a pint. Strain. To this may be added, as additional nourishment, beaten white of egg.

RICE-WATER.

Rice-water is made by boiling 2 ounces of clean rice in 2 quarts of water for one and a half hours.

WINE-WHEY.

Boil 1 pint of fresh milk; while boiling pour in 1 small tumblerful of sherry wine (8 tablespoonfuls); bring to the boil a second time, being careful not to stir it; as soon as it boils set it aside until the curd settles, and pour off the clear whey.

ALMOND BREAD FOR DIABETICS.

Take of blanched sweet almonds $\frac{1}{4}$ pound; beat them as fine as possible in a stone mortar; remove the sugar contained in this meal by putting it into a linen bag and steeping it for one-qaurter hour in boiling water acidulated with vinegar; mix this paste thoroughly with 3 ounces of butter and 2 eggs. Next add the yolks of 3 eggs and a little salt, and stir well for some time. Whip up the whites of 3 eggs and stir in. Put the dough thus obtained into greased moulds, and dry by a slow fire.

BRAN BREAD FOR DIABETICS.

Take a sufficient quantity (say 1 quart) of wheat-bran; boil it in two successive waters for one-quarter hour, each time straining it through a sieve; then wash it well with cold water (on the sieve) until the water runs off perfectly clear; squeeze the bran in a cloth as dry as possible, then spread it thinly on a dish and place it in a slow oven; if put in at night, let it remain until morning, when, if perfectly dry and crisp, it will be fit for grinding. The bran thus prepared must be ground in a fine mill and sifted through a wire sieve of such fineness as to require the use of a brush to pass it through; that which remains in the sieve must be ground again until it becomes quite soft and fine. Take of this bran powder 3 ounces (some patients use 4 ounces), the other ingredients as follows: 3 new-laid eggs, $1\frac{1}{2}$ ounces (or 2 ounces if desired) of butter, and about $\frac{1}{2}$ pint of milk; mix the eggs with a little of the milk, and warm the butter with the other portion; then stir the whole well together, adding a little nutmeg or ginger or any other agreeable spice. Bake in small tins (patty-pans), which must be well buttered, in a rather quick oven for about one-half hour. The cakes, when baked, should be a little thicker than ship biscuit; they may be eaten with meat or cheese at breakfast, dinner, and supper; at tea they require rather a free allowance of butter, or they may be eaten with curd or any of the soft cheeses.

It is important that the above directions as to washing and drying the bran should be exactly followed, in order that it may be freed from starch and rendered more friable. The bran in its common state is soft, and not easily reduced to fine powder. In some seasons of the year, or if the cake has not been well prepared, it changes more rapidly than is convenient, owing to moisture. This may be prevented by placing the cake before a fire for five or ten minutes every day.

ALMOND MILK.

Add 1 to 2 ounces of scalded sweet almonds, deprived of their skins, to a little hot water and thoroughly rub them into a pulp, adding nearly 1 pint of scalding water while rubbing. Then boil for fifteen minutes; strain, and add enough water to make a pint. This may be sweetened with sugar if desired, and is excellent for children who cannot take milk.

ARTIFICIAL MILK FOR DIABETICS.

Williamson has given the following recipe: "To about 1 pint of water placed in a large drinking-pot or tall vessel, about 2 or 3 tablespoonfuls of fresh cream are added and well mixed. The mixture is allowed to stand for twelve to twenty-four hours, when most of the fatty matter of the cream floats to the top; it can be skimmed off with a teaspoon easily, and on examination it will be found practically free from sugar. The milk-sugar remains dissolved in the water. This fatty matter thus separated is placed in a glass and mixed with water. Then the *white* of an egg is added and the mixture well stirred. The water and white of the egg are added in sufficient quantities to make a mixture which has the exact color and consistence of ordinary milk. If a little salt and a trace of saccharin be added, a palatable drink is obtained which has almost the same taste as milk, and which contains a large amount of fatty material and is practically free from milk-sugar. With very little practice the right proportions can be easily guessed, and, of course, much larger quantities than those mentioned can be prepared."

JUNKET.

Add from ½ to 1 teaspoonful of Parke, Davis & Co.'s essence of pepsin or Fairchild's essence of pepsin to a pint of milk, which should be at body-heat. Place the milk in a cool place, and after the curd has formed serve cold and flavor with powdered nutmeg or vanilla. If there be too great feebleness of digestion to digest the curd, the liquid whey may be given, as it contains the salts and soluble albuminoids of the milk.

Junket may be considerably increased in nutritive value if to the milk before it is warmed is added an egg which has been thoroughly beaten. In place of the egg 1 tablespoonful of cocoa may be added to 2 teaspoonfuls of sugar and rubbed into a paste with a little water. This is added to the warm milk, and then the pepsin is added to make the junket.

MULLED WINE.

Boil some spices—cloves, nutmeg, cinnamon, or mace—in a little water, and add as much of this decoction as is necessary to flavor a wineglassful of sherry or any other wine. Add sugar to taste, and bring the mixture to the boiling-point. If claret is used, it will require more sugar than if a less sour wine is employed. The vessel for heating the wine should be scrupulously clean.

WATERED TOAST.

Brown several pieces of bread, and carefully butter the toast so that the butter is equally distributed. Place enough salt over the toast to flavor it and add pepper to taste. Finally pour as much boiling water on the edges of the crust as is necessary to soak them thoroughly. and serve. This is a more agreeable dish than would be imagined, and is useful where milk toast is distasteful.

LIVER DIET IN PERNICIOUS ANEMIA.

When standardized liver extract cannot be obtained the following recipes may be resorted to. (See article on Anemia.)

Miss Nicholls, a dietician, recognizing the difficulty in getting patients to take large amounts of liver in the treatment of pernicious anemia, has suggested the following recipes:

Two hundred grams (6 ounces) of cooked liver is a day's ration. One calves' liver (uncooked) weighs from 2 to 3 pounds. It will lose about 40 per cent of its weight in preparation.

1. Broil slices of calves' or beef liver.
   Do not soak in water first.
   (Steam chicken livers.)
2. Remove veins and prepare as one of the following:
   - *A.* Chop in small pieces.
   - *B.* Mince coarsely.
   - *C.* Mince finely and strain.
3. Season with salt and a pinch of sugar.
   Moisten with gravy from roast meat, or with broth from meat or fowl.
   Additional distinctive seasonings are:
   Curry, chop suey sauce, Worcester sauce, tomato purée with Chili sauce, celery salt, onion salt, piccalilli, sherry.

With *A*, *B* or *C* flavored to taste, the following may be prepared.

Hot Dishes.

Pie, Cornish pastry or turnover of *A* and *B* plus cooked vegetables, covered with or enclosed in a plain pastry crust.

Shepherds pie of *B* or *C* covered with mashed potato and browned in the oven.

Stuffed Vegetables. Tomatoes, green or sweet red peppers, baked potatoes, etc., stuffed with *B* or *C*.

Indian curry of *B* or *C* with raisins and boiled rice.

Timbale. *A* mould lined with boiled rice or macaroni and stuffed with *B* or *C*. Steam invert, and serve with additional gravy.

Soup. *C* with addition of chicken or meat broth or milk. To vary, add strained tomatoes and Chili sauce or boiled rice.

Stew. *A* or *B* plus cooked carrots, onion, potatoes, leeks, served en casserole (improved with sherry).

Cold Dishes.

Liver in Aspic. *A, B* or *C* set in jellied meat broth or clear aspic jelly.

Liver Cream. *C* set in milk plus gelatine.

Tomato Salad. Tomatoes stuffed with *C* and garnished.

Stuffed Egg Salad. Hard boiled egg whites stuffed with *C*.

Sandwiches. *B* or *C* on toasted white or Graham bread or crackers.

Club Sandwich. *B* or *C* on toast with lettuce, tomato, mineral oil dressing, and thin slice of lean boiled ham.

PART IV.

DISEASES.

ABORTION.

The treatment of abortion divides itself into three parts: the first for its prevention, the second for its arrest when threatened, the third for its proper care when inevitable.

In a review of the preventive means we find, as in nearly every branch of medicine, that the use of hygienic measures is more important than the employment of drugs. If previous repeated abortions are known to have been due to syphilis, high blood-pressure, secondary infection of the decidua following an acute relighting of inflammatory processes in chronically infected foci, or uterine displacements, these conditions must be relieved by the proper remedies.

It is always to be borne in mind that syphilis is a very common cause of repeated abortion. If the history is suspicious or a positive Wassermann test is obtained neoarsphenamine is to be given, or the patient is to be placed on mixed treatment.

High blood-pressure and the underlying condition must be treated appropriately but no cathartics or laxatives should be used that promote pelvic congestion or uterine irritability. Aloes, castor oil, cantharides, elaterium, scammony and jalap are not safe. Cascara sagrada, phenolphthalein, Epsom salts, and other saline laxatives are sufficient to meet the indications and are unlikely to do harm. The patient should be warned of the danger arising from the use of remedies for the common cold which often contain quinine. Any physician who prescribes for her should be acquainted with the fact that pregnancy exists.

Chronic foci of infection should be eliminated if possible.

The uterus if retroverted or in descensus should be replaced and held with a pessary or the patient instructed in the daily use of the knee-chest and the Sims' position.

If there exists no apparent cause for the interruption of normal gestation, the patient should adopt a simple diet, lead a quiet life, avoid sexual intercourse, and resort only to gentle exercise. Automobile riding and especially driving a car should be reduced to a minimum. Fresh air is, however, a necessity, and should be plentifully supplied. The food should be light, but nutritious and palatable, and a sufficient variety provided to avoid any repugnance to a given dish.

In many cases abortion is due to deficient nutrition of the fetus, either by reason of faulty assimilation on the part of the mother or because of poor food, so that if anemia, debility, or other impoverished states of the maternal system be present, these should be treated at once.

As it appears sometimes that faulty implantation and defective nourishment of the ovum may be responsible and as the secretion of the corpus luteum of pregnancy is supposed to favor the normal growth of the product of conception it is logical to administer lutein substance. (See Part II, Corpus Luteum.)

The clothing should be loose, the night's sleep undisturbed and of full length, and the mind be set at rest as far as possible in respect to household and other worries, and particularly diverted from the thought of possible uterine disturbance.

The use of drugs is to be limited strictly to the fulfilment of a distinct indication, and the employment of cathartics or powerful laxatives is to be avoided, the bowels being kept in order by fresh fruits in moderate quantity or by mild laxatives, such as, mineral oil, cascara sagrada and phenolphthalein, either alone or in combination. Strychnine, which stimulates the spinal cord, should never be employed, and oil of erigeron, and manganese should not to be used unless they are for some reason very necessary. Although quinine is not of itself an abortifacient, it is unsafe in any dose if an abortive tendency is present, and can only be used as a prophylactic in those rare cases in which an abortion is threatened by a malarial infection.

The only drug of any reputation as a prophylactic to be taken all through pregnancy is the fluidextract of viburnum prunifolium, the dose of which is $\frac{1}{2}$ to 1 dram (2.0–4.0). This drug when prepared from selected bark is a mild uterine sedative and has no injurous effect upon the mother or the child.

The arrest of threatened abortion is one of the most difficult duties which come to the physician, and there is no doubt that large doses of opium or its derivatives are the best means of quieting the uterus. Patients in whom abortion is especially feared should be supplied with capsules of codeine, grain $\frac{1}{4}$; extract of hyoscyamus, grain $\frac{1}{3}$; and extract of viburnum prunifolium grain v, with instructions in the event of uterine pain or bleeding to lie down flat on their back in bed and take a capsule every hour until a physician can be reached. The patient should be kept in bed comfortably placed but without elevation of the shoulders so there is no tendency to pelvic congestion, and so covered as to prevent overheating or taking cold, and receive by hypodermic needle $\frac{1}{4}$ grain (1.015) of morphine, and after this a rectal injection of warm starch-water containing 45 minims (3.0) of laudanum with the addition if it seems desirable of sodium bromide. The bulk of the injection should be small in order not to disturb the bowels, and must be at the body temperature. If this is not done a suppository of the extract of opium containing $\frac{1}{4}$ to $\frac{1}{2}$ grain (0.015–0.03), should be used. No stimulants should be taken, no coffee or tea should be allowed and everything should be done conducive to repose. This treatment quiets the uterus, allays nervousness and restlessness, and at least puts off the abortion for a few hours. Venesection has been practised in very plethoric women with advantage.

When an abortion is inevitable, it is to be treated by measures directed to the avoidance of hemorrhage, the complete delivery of the ovum and its appendages, and the prevention of inflammation and septicemia. The latter accident is to be prevented by the most rigid asepsis of the patient and physician. For the prevention of hemorrhage, a cervico-vaginal pack should be introduced without anesthesia. The patient is placed in the lithotomy position, the external genitalia, vagina and cervix are thoroughly and gently cleansed with warm solutions of liquid soap, sterile water and bichloride 1 to 1000; by washing the exterior first and then introducing a bivalve speculum well lubricated with the soap solution into the vaginal canal, all parts of the vagina may be thoroughly cleansed and disinfected. The bivalve speculum may then be replaced with a Sims' and the cervix gently caught with a tenaculum. A gauze pack is then placed in the cervix and continued around it in the vaginal vault, until the fornices and vagina are snugly but completely filled. By reason of this packing the blood in the uterus cannot escape, and as the uterine walls contract they urge the liquid between the membranes, thereby causing complete separation. The cervix softens, becomes obliterated and the canal dilates, promoting expulsion of the uterine contents.

Often after thirty-six hours the removal of the pack will show the ovum and the placenta to be in the vagina, but if some part of the products of conception remain in the uterus they should be removed. This is accomplished with the finger and dull placenta forceps. The cervix usually at this time readily admits the finger or will do so after a little additional gentle instrumental dilatation; with the finger the entire cavity should be palpated and portions of placenta attached to the uterine wall removed, the operator's second hand manipulating the uterus through the abdominal wall. It may be desirable in order to reach the fundus to insert the entire hand into the vagina, and this in primipara may require perineotomy with subsequent and immediate repair. The detached fragments are then to be removed with the placental forceps.

Rubber gloves must be worn and the strictest aseptic precautions observed throughout. After the uterus is emptied, it should be packed with gauze which is left in place for twenty-four hours and then removed. A plain gauze strip with infolded edges (no selvage) long enough so that it will serve not only for the uterus but also the vagina should be used; plenty of sterile vaseline on the vaginal part of the gauze strip will greatly facilitate its removal. After the uterus is packed and before continuing the pack in the vagina, the uterus is replaced as it has nearly always been drawn downward by the procedure described. During the act of removing the gauze from the uterus a finger on the anterior wall of the cervix prevents displacement of the uterus downward. The after-care includes rest in bed and small doses of ergot or pituitrin to promote involution; after four or five days if the temperature is normal and there is no indication of inflammatory trouble in the pelvis; the regular use of the knee-chest position should be started and later on a pessary may be added if there is any descensus or retroversion.

When symptoms of a threatened abortion are associated with an elevation of temperature, then one must be careful to avoid intra-uterine manipulation until the temperature has come down to normal. To this end the patient should be put to bed in the Fowler position, ice-bags placed upon the lower abdomen and the diet restricted to liquids. Such a plan almost invariably results in a drop of the temperature to normal, when the treatment already described for inevitable abortion may be instituted. Excessive bleeding however even in febrile cases forbids temporizing measures. Under those circumstances, the treatment for the threatened abortion may be carried out with propriety at once, the manipulations being made with the least possible disturbance and careful avoidance of unnecessary traumatism.

ABSCESS.

The medical treatment of abscess is to support the body if the suppuration be prolonged or in large amount, or if debility exists.

An acute abscess in its early stages is simply a localized inflammation with hyperemia and an outpouring of leukocytes. It may often be modified by applying lint heavily smeared with 50 per cent ichthyol and lanolin. Belladonna ointment smeared over the same area may be of service. If a gland be involved the needle of a hypodermic syringe may be inserted perpendicularly into its center and 5 to 10 minims (0.3–0.6) of a 2 per cent solution of phenol injected into the swelling. This method has been found of singular efficacy in bubo when pus seems just about to form. It is very often curative, but should not be used in a stronger or weaker solution than that named. Another useful abortive method for the treatment of the early stages of abscess is the application, externally, of a strong solution of nitrate of silver, 20 to 40 grains to 1 ounce (1.3–2.6 to 30.0) of water, by means of a camel's-hair brush, all over the skin covering the area involved, or by the use of the tincture of iodine in a similar manner.

If it becomes evident that pus is going to form, then resort must be had to poultices, which by their heat and moisture will aid in the formation of pus by favoring the escape of leukocytes and by softening the tissues. The best form of poultice for this purpose is to use lint which has been saturated with a 1 to 4000 solution of mercuric chloride, the moisture being retained by a piece of rubber dam placed over the lint. If pus forms and fluctuation ensues, the abscess should be freely opened, drained, washed out by normal salt solution, or bichloride solution 1 to 5000, and dressed with antiseptic gauze. If it is tuberculous, the abscess may be opened in the ordinary manner, and the cavity packed with iodoform gauze. (See Adenitis, Part IV, Iodoform Part II, Heliotherapy Part III.) Not more than 20 grains (1.3) of iodoform should be so used in the treatment of tuberculous abscess, as larger amounts have caused poisoning. (See also Bismuth, Part II.)

A very good treatment for slow abscess is to wash out the cavity with a 10-volume solution of peroxide of hydrogen, provided there is a free exit for the gas which is given off.

If the abscess is chronic (cold abscess) and associated with great weakness, resort must be had to the internal use of iron in the form of the tincture of the chloride, cod-liver oil, quinine as a tonic, and the use of nutritious, easily digested food. Whisky may be used, and should be given with milk or in egg-nog. (See Vaccine Therapy.)

The following tonic pill or solution is of service:

℞—Strychninæ sulphatis	gr. j (0.06)
Arseni trioxidi	gr. ¼ (0.015)
Ferri reducti	gr. x (0.65)
Quininæ sulphatis	gr. xx (1.3).—M.

Fiant pilulæ, No. xx.
S.—One t. i. d. after meals.

Or

℞—Tincturæ cinchonæ compositæ,
Tincturæ gentianæ compositæ,
Tincturæ cardamomi compositæ . . . . āā f℥iij (90.0).—M.
S.—Dessertspoonful (8.0) t. i. d. after meals.

Having described the means of treatment, it is to be explained how these measures act. When phenol is injected into an enlarged gland it acts as an anesthetic, as an antiseptic and as an astringent. The nitrate of silver applications act by constringing the bloodvessels, as a local sedative and as a counterirritant. The iodine applications do likewise, and also exercise an antiseptic influence. The object in using the antiseptic irrigations is self-evident, and the employment of iodoform in tuberculous abscess rests upon the studies of Bruns, of Tübingen, and many others, who have found by experiment that the use of iodoform is fatal to the Bacillus tuberculosis.

As large numbers of corpuscles are destroyed in the formation of pus, and other sources of vitality are sapped by its formation, the use of arsenic and iron to replace the loss is necessary, and of cod-liver oil and tonics to increase the blood corpuscles and the ability to assimilate food. (For the use of bismuth in the treatment of abscess see Bismuth, Part II.)

ACNE.

This affection occurs in so many forms and arises from such different causes that a thorough consideration of its treatment cannot be here given: suffice it to state that arsenic is a remedy which will often aid in the cure and prevent a relapse if used in small doses for a long period; that is, 1 to 3 minims (0.06–0.2) of Fowler's solution three times a day for a month or two. This is particularly useful if debility and anemia underlie the disease. If the anemia be marked, the proper treatment is that directed to the cure of this condition (see Anemia); if obstinate constipation is present, relief must be obtained by saline purges and the bowels kept in order by cascara sagrada or some similar drug. If general debility exists, cod-liver oil is of great service; or if much pustulation is present, calx sulphurata, in the dose of $\frac{1}{10}$ to $\frac{1}{8}$ grain (0.006–0.008), may be used in pill form three times a day. In menstrual acne, sulphur may be used internally, in the form of the confection of sulphur of the British Pharmacopœia, to open the bowels, and applied as a wash to the face in the following form:

℞—Sulphuris		ʒj (4.0)
Glycerini		f℥j (30.0)
Aquæ rosæ	q. s. ad	f℥viij (240.0).—M.

S—Apply twice or thrice a day.

Or the following may be used in cases of severe inflamed acne:

℞—Sulphuris iodidi	gr. xxx (2.0)
Cerati	℥j (30.0).—M.

S.—Apply to the parts night and morning.

If the skin is very atonic, muddy, and torpid, it should be bathed night and morning with hot water and castile soap, or even with the tincture of green soap, and well rubbed with a rough towel. After this the following salve may be thoroughly applied:

℞—Sulphuris præcipitati		ʒss (2.0)
Adipis lanæ hydrosi,		
Adipis	āā	℥ss (16.0).—M.

S.—Apply as directed.

If the green soap causes irritation, some bland application should follow it, such as simple cerate or the emulsion of the oil of sweet almonds. If the pustules be large, they may be incised, a small Bier cup applied, and vent given to their contents, the sac being swabbed with a drop of phenol, or a drop of camphor, 3 parts, phenol, 1 part, may be employed. (See Phenol.) If induration is great, ichthyol ointment of the strength of 20 parts of ichthyol to 100 of lard should be well rubbed in, or resorcinol, 10 to 20 grains to 1 ounce of lard (0.6–1.3 to 30.0), be applied. Mercurial ointment may also be used to lessen induration, but several days should elapse between its use and that of sulphur, as otherwise a black sulphuret of mercury will be formed and stain the skin.

The diet should be carefully regulated and fatty foods avoided.

Stains of the skin after an acne pustule has healed may be removed by—

℞—Aquæ hydrogenii dioxidi	f ʒj (4.0)
Adipis lanæ hydrosi	f ʒvj (24.0).—M.

Ft. unguent.
S.—Apply locally.

An autogenous vaccine is often very valuable. Indeed, staphylococcus vaccine has done better in acne and furunculosis than in any other use of vaccine-therapy. (See Vaccine-therapy.)

ADENITIS.

Cervical adenitis is an inflammation of the lymph nodes, usually due to tuberculosis. It may also arise from other forms of infection by way of the mouth or tonsils, and if the tonsils are diseased they should be removed. So should bad teeth.

If the condition is a simple enlargement, it may be treated by applying iodine ointment and lard, half-and-half, night and morning, care being taken that the use of the ointment is stopped as soon as reddening of the skin appears or if fluctuation develops. If for any reason the ointment cannot be used, the tincture of iodine may be thoroughly painted over the swelling, but this treatment is less efficacious. The following is a useful application:

℞—Ichthyolis	f ʒiv (16.0)
Adipis benzoinati	f ℥ij (60.0).—M.

S.—Rub gently a small piece of the ointment over the swelling t. i. d.

Syrup of the iodide of iron, in the dose of 5 to 20 drops (0.3–1.3), may be given, and tonics should be used to improve the systemic condition. A fresh-air life and residence at the seaside is desirable. Indeed, heliotherapy is one of the most efficient cures, and in its place the mercury quartz lamp or the light from the carbon arc lamp may be used. As soon as fluctuation or reddening shows the formation of pus, all abortive treatment should be stopped. The pus may now be removed by aspiration, and the cavity injected with iodoform emulsion if the cause is tuberculous. Often the iodoform is not needed. If the pus reforms the puncture may be repeated. If this fails a small incision is to be made and a drain of bismuth or iodoform gauze inserted. The cavity is not to be packed. If the abscess is deep it may be drained by a rubber tube or iodoform gauze. Do not wait for the abscess to break, as the scar left in after years forms a large cicatrix.

If, after fluctuation is present, the swelling disappears in part under rubbing with an ointment, this indicates not betterment, but that the abscess has ruptured into the surrounding tissues and it should be incised at once, freely drained and swabbed out with tincture of iodine. The radical operation of removal of the enlarged glands should, if possible, wait until the process is localized. Excellent judgment as to the time of operation is often required to prevent general infection as the result of operation.

When these nodes are chronically enlarged they are best treated by radium or the roentgen-rays, particularly if they are tuberculous. When chronic discharging sinuses, tuberculous in character, are present they may be treated by the use of tuberculin and heliotherapy, but in many cases radium is adequate. When malignant, roentgen-rays or radium should be resorted to before the knife is decided upon as the best measure for relief, but there is an honest difference of opinion as to the best plan. When hard fibrous masses are present as the result of prolonged inflammation, and are disfiguring, operation is indicated, but even in these cases radium or the roentgen-rays may be employed in certain cases with advantage.

ALCOHOLISM.

(See ALCOHOL.)

ALOPECIA.

This affection, when due to a parasite, is best treated, according to Crocker, by first pulling out all the loose hairs around the bald spot and then painting the affected surface with linimentum cantharidis (liquor epispasticus). Three coats of this liquid should be employed, and each coat allowed to dry before the next is applied. In other cases an ointment of chrysarobin, ½ to 1 dram (2.0–4.0) to 1 ounce (30.0) of lanolin, may be used, but care must be exercised that too much staining of the skin and clothes does not result. Another equally good application is 2 grains (0.12) of mercury bichloride to 1 dram (4.0) of rectified spirit and 7 drams (28.0) of oil of turpentine. This mixture may be rubbed in with the finger over and around the patch. If the patient's skin will stand it, 5 grains (0.3) of the corrosive sublimate may be used in place of 2 grains (0.12).

AMBLYOPIA AND AMAUROSIS.

Amblyopia (or dull vision) and amaurosis (or blindness) are often used to describe defective sight or its total loss, the result of disturbance of the retina, optic nerve, or visual centers, and unaccompanied by changes in the eye-grounds in the beginning of the disease. These terms, however, also include cases of partial or complete blindness in which optic-nerve atrophy subsequently develops, and are frequently used to indicate ocular disorders not limited by the definitions here employed. Such cases may be gathered into certain groups:

I. Congenital amblyopias and amblyopias from non-use of the eye. In these there is often a high degree of error of refraction, usually farsightedness, for example, and where an eye is debarred from binocular vision by a squint. In both the treatment consists in as perfect a correction of the optical error as possible, and in case one eye alone is involved, the separate exercise of its functions. Congenital amblyopias may be due to incurable defects in the structure of an eye.

II. Amblyopia is often employed to describe the defective vision caused by various local and general conditions; for example, uremic amblyopia, glycosuric amblyopia, pregnancy amblyopia, malarial amblyopia, amblyopia from loss of blood, and hysteric amblyopia. Naturally, the treatment depends upon the etiological factor. If this is controlled the ocular lesions may disappear. In some instances they are permanent. Hysterical amblyopia is readily cured by suggestion.

III. Amblyopias the result of the action of certain medicinal and toxic agents.

Due to the abuse of tobacco or of tobacco and alcohol, a form of amblyopia may develop characterized by a scotoma, or an area in the field of vision "between fixation and the blind spot." in which the appreciation of red and green is lost or greatly diminished; indeed in this region of the field there is a relative scotoma for all colors and also small white test objects and its features are practically distinctive. The optic nerves of diabetics are especially liable to the deleterious influence of tobacco. Quinine in excess has, in a number of instances, been followed by temporary blindness, which is usually denominated *quinine amaurosis*. The blindness following the administration of toxic doses of ethyl-hydrocuprein (optochin), especially in the treatment of pneumonia, resembles that of quinine amblyopia. Methyl alcohol by itself or in so-called purified wood alcohol which appears in commerce under the name of Columbian Spirits, Colonial Spirits, Eagle Spirits, Manhattan Spirits, etc.; or in the form of adulterated essence of ginger or bay rum, even in comparatively small quantities, may produce rapid blindness and atrophy of the optic nerve. The substitution of wood alcohol for ethyl alcohol in illicit whisky and other alcoholic beverages has been responsible for many fatalities and numerous cases of permanent blindness. Of less frequent occurrence are the cases of amblyopia produced by the toxic action of salicylic acid, lead, silver, mercury, osmic acid, nitrobenzol, filix mas, thyroid extract, the vapor of disulphide of carbon and carbon monoxide. Blindness from atrophy of the optic nerves has not infrequently followed the administration of atoxyl and of the other arsenates, for example, soamin, arsacetin, hectin, orsudan. Tryparsamid is capable of producing serious ocular disturbance and during its administration the eyes must be frequently examined, especially the visual fields. In all instances the patient must be withdrawn from the influence of the poison; in tobacco amblyopia, in its early stages, this is usually sufficient to effect a cure. The remedies which have proved of the greatest utility are digitalis, inhalations of nitrite of amyl, nitroglycerin, and strychnine. Diaphoresis is valuable. Iodide of potassium should be exhibited. The constant current has also been employed. The prognosis as to sight is exceedingly grave in methyl alcohol blindness. Alkalies may be administered to neutralize acidosis which is present in the early stages of the toxemia; lumbar puncture has been advised.

IV. Amblyopias the result of direct or indirect injury or from reflex irritations.

Traumatic amblyopias may follow a blow upon the eye itself or an injury of the skull or spinal cord. Fractures of the base of the skull or of the optic canal may cause optic nerve atrophy which is irremediable.

So-called "reflex amblyopia" vaguely attributed to irritations in distant portions of the body is an unscientific term which should be eliminated. Modern methods of examination have greatly lessened the number of conditions to which the older writers applied the words "amblyopia" and "amaurosis;" indeed, it is time to dismiss these words from classifications of ocular disorders, except in so far as they are synonyms of dimness of vision or of loss of vision.

Optic Neuritis, Choked Disc and Optic-nerve Atrophy.

Optic neuritis (papillitis) and choked disc (papilledema) most frequently depend upon diseases of the brain (tumor, abscess, gumma, aneurism, thrombosis of cavernous sinus) or inflammation of its membranes (meningitis). Papillitis (optic neuritis) may arise from a general infection—influenza, syphilis, malaria, the exanthemata, tuberculosis, etc.; or from a paranasal sinus infection (ethmoiditis, sphenoiditis). It is also caused by anemia, excessive hemorrhage (generally uterine or stomachic) and certain toxic agents, for instance lead, atoxyl, filix mas, and alcohol. The remedies are those naturally suggested by the etiological factors. The prognosis depends upon the cause. Mercury, iodide and bromide of potassium, the salicylates and pilocarpine, and diaphoresis are commonly employed. Choked disc dependent upon increased intracranial pressure, in its turn due to brain tumor, is best treated by decompressive trephining, and if the tumor is accessible by removal of the growth. Injuries of the skull (blows, fractures) may be followed by rapid disc edema (choked disc) and repeated ophthalmoscopic examinations are required.

Optic-nerve atrophy may be *primary*, *secondary*, *consecutive* (*neuritic* or *postpapillitic*) or may be due to retinal or choroidal disease, or due to various causes already named in connection with the description of the effect of toxic agents and traumatisms. Common causes of primary atrophy are syphilis, locomotor ataxia, paretic dementia and insular sclerosis.

Treatment.—This depends upon the cause. If syphilis is present, the usual remedies are indicated; but mercury is useless in advanced cases, even in syphilitics. Salvarsan or neosalvarsan or their equivalents, arsphenamine and neoarsphenamine, exercise no detrimental effect on a healthy optic nerve. Rapid loss of vision in patients with tabetic atrophy has followed the use of salvarsan. A number of observations are on record which seem to indicate that neoarsphenamine, if used early and while color preception is still good, represents a therapeutic agent of value in the treatment of tabetic atrophy.

But much difference of opinion exists as to the advantage of arsphenamine in the treatment of luetic atrophy of the optic nerves. The author's experience coincides with that of those observers who state that the drug is of no value in the optic nerve atrophies due to syphilis in so far as the atrophy itself is concerned.

Arsphenaminized serum, injected intraspinously (Swift-Ellis method), is said to do good if employed before the degenerative process has begun. In the author's experience it has been entirely unsatisfactory. S. R. Giflord's observations indicate that *intracranial,* that is, *intracisternal* injections of bichloride of mercury ($\frac{1}{50}$ grain of the drug being introduced into the lateral ventricle and repeated as required) is a better procedure than intraspinous injections of arsphenaminized serum. The treatment is not without danger; fatalities have occurred. Strychnine has been much employed administered in full doses, preferably by the hypodermic method; it may be enforced by nitroglycerine. Other remedies, according to the cause, are iodide of potassium, nitrate of silver, phosphorus, arsenic, iron, santonin, lactate of zinc, hypodermics of antipyrin (Valude), and injections of organic liquids, all save iodide of potassium, of doubtful value. Bismuth (sodium and potassium tartrobismuthatum aqueous solution and in oil suspension, administered intramuscularly, not intravenously) has been much employed in the treatment of primary, secondary and tertiary syphilis. It has also been employed in neurosyphilis and favorable results recorded. Negative galvanism has been advised, and good results have been reported. Coleman especially recommends the *sinusoidal current,* a binocular electrode being placed over the eyes and an oval pad to the nape of the neck. The treatment should take place for twenty minutes each day. High-frequency currents and phototherapy have been advocated. There is no satisfactory evidence that radium and the roentgen-rays are useful therapeutic agents in the treatment of optic-nerve atrophy.

AMENORRHEA.

This condition depends upon so many causes for its existence that it must be treated in many different ways. If ordinary anemia or chlorosis shows that there is a deficient supply of blood, measures adapted to the relief of such a state are required. (See Anemia.)

In amenorrhea due to constipation saline purges or other laxatives may be used, and the best of these purges is aloes. As constipation and anemia are often present simultaneously, a combination of aloes and iron in a pill is commonly resorted to. The iron improves the blood, and the aloes stimulates and congests the pelvic viscera by bringing the blood to the pelvic organs. Aloes also seems to increase the assimilation of iron in some unknown manner. The following pill is often of service, and was especially recommended by Goodell:

℞—Extracti aloës	ʒj (4.0)
Ferri reducti	ʒj (4.0)
Asafœtidæ	ʒiv (16.0)

Fiant pilulæ, No. c.
S.—From one to three pills three times a day before each period.

Cimicifuga has been highly recommended in chronic and apparently causeless amenorrhea in the dose of 30 minims (2.0) of the fluidextract three times a day at the time for a proper flow to occur. Corpus luteum in 5 grain (0.3) tablets or capsules is a good remedy but the intramuscular injection every day or every other day of extract of whole ovary, as now provided in ampoules, is perhaps better. (See Corpus Luteum.) As calcium lactate and a vitamine A diet increase ovulation and fertility, they may have an appreciable effect upon those cases of amenorrhea that result from deficient ovulation.

Apiol, the active principle of parsley, may be given in capsules in the dose of 3 to 10 minims (0.2–0.6) in the same manner.

In all forms of amenorrhea a hot sitz-bath at the time for the expected "period" is of service, more particularly if the patient has "caught cold." The bath should be persevered in for several nights, and care should be taken to avoid exposure. Often a little mustard added to the water will increase the efficacy of this treatment.

ANAL FISSURE.

This is one of the most painful affections to which man is subject, and requires intelligent treatment, generally by surgical means if the result is to be curative, although great relief can be obtained by the use of drugs.

The most annoying feature of the lesion is the intensity of the pain on defecation, which is so severe that emptying of the bowel is postponed as long as possible by the patient.

To relieve this pain and enable the patient to have a fairly comfortable stool, nothing is so good as an iodoform suppository containing 10 grains (0.6) of the drug, preceded the night before by an enema of sweet oil, and retained to soften the feces. Iodoform being a local anesthetic, the passage may take place with very little suffering. If much spasm of the sphincter is present, extract of hyoscyamus, $\frac{1}{2}$ grain (0.03), may be added to each suppository. For the cure of the fissure a drop of strong phenol may be applied to the spot, and a lotion of tannic acid, glycerin, and water used if hemorrhoids are also present. Ringer highly recommended the application to the fissure, by means of a brush, of a solution of bromide of potassium, 1$\frac{1}{2}$ drams to 1 ounce (6.0–30.0) of glycerin. In order that the passages may be soft and yet the patient not be purged, sulphur may be given in the dose of 20 to 40 grains (1.3–2.6) every night, or, if this cannot be used, mineral oil may be administered. The best way to give the sulphur is by combining it with powdered cinnamon or aromatic powder. Sometimes relief is obtained by the use of flexible collodion painted over the fissure. Pure ichthyol locally applied sometimes does good.

The radical means of cure consist in stretching the sphincter ani under anesthesia. This is followed by incising the base of the fissure, curetting it, and then touching it with a stick of nitrate of silver.

ANEMIA.

It is, unfortunately, only too true that the entire subject of blood-making and blood-breaking is as yet very imperfectly understood, but many of our therapeutic facts rest on rational ground. Practically speaking, the therapeutist recognizes two very important points—namely, that one class of anemias is secondary to some more or less obvious cause, as lack of good food and fresh air, excessive menstruation, hemorrhoids or other cause of blood loss. The other type is called the essential or pernicious class, and is characterized by excessive hemolysis, or defective hemogenesis or both causes. More than this, the causes of excessive hemolysis are so various that we can further divide them into removable and permanent, the removable being represented by the cases in which copremia or auto-intoxication takes place, while the others are represented by the true pernicious anemia, about which we know very little, save that most observers find evidence of defective hemogenesis, and of profound hemolysis in the percentage of iron in the liver. Unfortunately, it is at present impossible for us to separate clinically the anemia of defective hemogenesis from that of hemolytic excess, unless we find evidence of great corpuscular disintegration in a copious elimination of hemoglobin in the urine, or a jaundice evidently hematogeneous in character, or a large number of defective corpuscles, which would perhaps indicate defective hemogenesis rather than that they were scarred veterans of a battle with some toxic agent. Postmortem signs often aid us in the differential diagnosis, but this is too late to be of any benefit to the patient.

There is one point, however, about which there can scarcely be any doubt, and that is that in many cases iron is greatly abused, being given when there is no indication for it or more frequently given in excessive dose. By excessive dose the author refers to as much as 6 to 10 grains of reduced iron in a day. The amount of iron in the human body is very small, and every study made of its absorption and elimination after absorption has shown that these processes are very slow. Hamburger recovered from the feces nearly all the iron administered, and Jacobi proved that even when the iron was injected into the veins 10 per cent was at once eliminated by the bowels, liver, and kidneys, and the remainder deposited in the liver, spleen, and other tissues in the same manner as is any metallic substance. The researches of Gottlieb have also been in confirmatory lines. When we consider that there is in the human blood only about 39 grains of iron, all told, we can see that the use of 12 grains a day in the course of a little over three days places a double quantity of the metal in the economy, which is not needed, and is either cast out or deposited at any convenient spot, there to lie undisturbed until it can be extruded.

Much, of course, depends upon the cause of the anemia, but there is only one excuse for the use of the large doses of iron just named—viz., a condition of the digestive apparatus which results in the formation of a sulphide of iron in great quantity, so that only an infinitesimal amount escapes into the system. This perhaps explains the empirical fact that in some cases of chlorosis or intense anemia iron has to be given in large doses or hypodermically to accomplish good results.

One of the best studies on this subject is that of Ralph Stockman, who has given us a masterly summary of the subject of the absorption in iron in chlorosis. In this summary he points out that we have three chief theories as to the action of iron in anemia. The first, the absorption theory, is based on the fact that as iron is taken into the body with the food, the iron of the hemoglobin must be obtained from this source, and therefore that medicinal iron given by the mouth must be absorbed. The second theory rests upon the belief that iron is not absorbed when given by the mouth in addition to that in the food, but simply acts as a stimulant to the mucous membrane of the alimentary canal, therefore increasing the digestion of food and so overcoming anemia by the general improvement coincident upon proper nutrition. This theory is of little value, as it has been proved that all forms of iron are absorbed. The third theory is that of Bunge—namely, that in chlorotic conditions there exists an excess of sulphur or sulphuretted hydrogen in the bowel, which changes the iron in the food into a sulphide of iron, which Bunge states cannot be absorbed. He believes that the inorganic iron which is given as a medicine saves the organic iron of the food by combining with the sulphur, and so indirectly cures the anemia by the protection afforded the food-iron. It is important to remember that each of these theories has been supported by many careful experiments, but it is also well to bear in mind that the hypotheses and the experiments supporting them may be erroneously based. Thus, we have no right to imagine that the inorganic preparations of iron have a stimulating power over the alimentary mucous membrane, or, even if they have, that this power is exercised in the peculiar line of aiding in the absorption of the organic iron of the food. Again, the researches of Hamburger, Damaskin, Gottlieb, Müller, Jacobi, and Socin, which show that after the internal use of inorganic iron there is no increase in the iron in the urine, are valueless so far as the conclusions drawn by them are concerned—namely, that as there is no increase in iron in the urine, there is none in the blood, and therefore it is not absorbed. These conclusions are not justified, because they are based on the erroneous views that because iron is not in the urine it is not in the blood, and because it is not in the blood it is not absorbed. Every one knows that in the case of chronic lead poisoning, when the body is saturated with the metal, there is often no lead in the urine, the poison being deposited in the tissues; and if this is true of lead, it may be of iron. Particularly is this to be remembered when we find Stockman quoting the researches of Mayer, Bidder, and Schmidt, and a host of others, who have proved that we are not to look to the kidneys as the path for the excretion of iron, but to the intestinal walls. Finally, when iron is used hypodermically it cures anemia, although it cannot under these conditions stimulate the digestion or combine with sulphides.

Iron will not cure all cases of anemia, even if they belong to a secondary type, but other methods must be resorted to at the same time or separately for their cure as, for example, the simultaneous use of liver extract. (See Pernicious Anemia in this article.) This use is particularly valuable in slow convalescence from severe hemorrhage. Reduced iron is the best chalybeate for uncomplicated cases. Besides using iron in this form, we should employ laxatives if the bowels are confined; mineral acids, particularly nitric and nitrohydrochloric, for their effect on the function of the small intestine and liver; and in addition, bitter tonics of a more or less simple form, according to the exigencies of the case, using quinine or simple bitters if the stomach lacks tone, aromatic bitters if the digestive tract seems sluggish from atony of the muscular coats, with a resulting formation and accumulation of flatus and lack of digestive juices.

The preparations of iron best employed in anemia are the insoluble forms just named, such as reduced iron or the carbonate, but there are indications for each salt which must be regarded. In many anemic persons, particularly females, the tongue is broad and white, not from coating, but pallor—is flabby and torpid looking. Under these circumstances the bowels should be kept moving by mild purges, and a bitter tonic like calumba and tincture of the chloride of iron be taken by the patient. In the anemia caused by rapid child-bearing and lactation, cod-liver oil, with iron and quinine in tonic dose may be also of service. With some practitioners Blaud's pill is very much used, made as follows:

℞—Ferri sulphatis exsiccati,
Potassii carbonatis . . . . āā ʒij (8.0)
Syrupi . . . . q. s.—M.
Fiant pilulæ, No. xlviii.
S.—One to three pills three times a day, after meals.

In cases of marked secondary anemia, in which the broad, flabby state of the tongue indicates poor absorbent power of the alimentary tract, and in pernicious anemia, citrate of iron may be given intramuscularly with advantage. It is best given by use of sterile ampoules containing about ½ grain (0.02) once or twice a week. (See Iron.)

Inunctions of very small amounts of mercurial ointment once a day or every other day, in adults and in children, will increase the fulness and redness of the cheeks and lips and the number of the corpuscles, the piece of ointment used being no larger than one-half of a very small pea. This treatment will be found of service in cases not necessarily dependent upon specific taint. The marked increase in the nutrition of children of a syphilitic taint who are suffering from marasmus under the internal use of gray powder and full inunctions of mercurial ointment is most extraordinary.

Arsenic is of particular merit in those forms of anemia in which the blood cells are lacking in number rather than in hemoglobin. Any one of the preparations of arsenic may be employed, and should the anemia be pernicious in its type, or should it depend upon leukemia or pseudoleukemia, the arsenic must be pushed in ascending doses until marked evidences of its general effects are manifested and for this effect the cacodylate of sodium in the dose of 1 to 2 grains (0.06-0.12) may be given hypodermically every other day until diarrhea, renal irritation or a garlic odor of the breath develops.

In pernicious anemia the treatment and prognosis depend to some extent upon the blood picture under the microscope. In cases which are fairly favorable there will be evidence of efficient bone-marrow activity in the increase in the number of young red cells (reticulated cells), in an increase in the polymorphonuclear leukocytes and in the blood platelets, whereas a diminution in these cells indicates an inactive bone-marrow particularly in the case of the platelets. In the latter type arsenic is indicated in full doses, and in others moderate transfusion to compensate for the destroyed blood.

The introduction of raw or cooked liver, or extract of liver, in the treatment of pernicious anemia by Minot, Murphy and their co-workers has proved so useful that this plan of treatment is to be tried in all cases in preference to any of the older methods as it seems to exercise a specific effect. Under the influence of the liver treatment there takes place rapid blood regeneration and this is accompanied by a disappearance of many symptoms characteristic of the disease, as, for example, the peculiar yellowish tinge of the skin, the dyspnea and the sore tongue. Unfortunately the treatment has to be maintained indefinitely, at least to some degree, to prevent relapse. The most noteworthy change in the blood indicating the therapeutic effect of liver is the marked increase in the reticulocytes. When the red cells in a given patient are about 2,800,000 per cubic millimeter, the increase in the red cells apparently is due to the increase in reticulocytes but after the red cells get above 3,000,000 per cubic millimeter which usually takes some time, it would appear that the further increase in their number is due to the setting free of well developed or mature red cells from the bone-marrow. The primary increase in reticulocytes is so characteristic of the effect of liver therapy that Minot and Murphy believe that if they fail to increase this fact may be used as a means of therapeutic diagnosis and the conclusion reached that pernicious anemia is not present. In general terms the increase in cells is in direct ratio to the dose of liver or liver extract, that is to say when the dose of liver is 500 to 600 grams per day, or its equivalent, the cells which stood at 2,500,000 will be found to number at least 4,500,000 at the end of a month and the normal 5,000,000 will be present at the expiration of another thirty days. It is of interest to note that the hemoglobin increase is not as rapid as is the increase in cells.

The daily intake of liver or lambs' kidneys amounts to 4 to 8 ounces with 4 ounces of lean beef or mutton and at least 10 ounces of green vegetables, particularly spinach. In addition, from 10 to 20 ounces of fresh fruits are to be ingested with carbohydrates up to 10 ounces, and, if desired, an egg and a glass of milk. A little butter may be given with the bread or cereal. The basis of this treatment rests upon the idea that fats induce putrefactive changes in the intestine and because iron in an easily assimilated form is present in large quantity.

Liver extract appears on the market in tubes containing 2 grams of desiccated powder, representing 100 grams of fresh liver. Ordinarily the contents of 6 tubes are administered daily until the blood count is approximately normal, when the contents of 3 tubes a day will usually be sufficient to maintain his condition. Twenty-four vials usually come in a box.

The extract may be added to soup, hot water to which salt may be added, tea, coffee or milk as a ready means of having the patient ingest the medicament.

These extracts are prepared by different methods by various manufacturers, and are not all of equal value. One of them has dextro-maltose added to it to prevent it from becoming so solid that the powder is not easily taken from the tube.

Even when the general symptoms largely disappear and the red corpuscle count rises to 5,000,000 it is usually necessary to continue the liver treatment in smaller amount for a long period of time and perhaps always. The simultaneous use of iron is always desirable. (See Part on Feeding the Sick for Preparation of the Food.)

Very recently Sharpe, Sturgis and Isaacs have shown that an extract of stomach presents certain definite advantages over the liver treatment of pernicious anemia, in that it seems to be more effective in stimulating reticulocytosis is more stable than ordinary liver extract, is more palatable, and seems to do better when prolonged treatment is essential.

In the same manner that liver extract is controlled by a special commission of Harvard University, so is stomach extract controlled by the Simpson Memorial Institute of the University of Michigan.

The product is called Ventriculin and it is made from the stomach of the hog. So far it would appear that the dose varies from 15 to 40 grams a day, and it is often wise to associate with it full doses of hydrochloric acid which has been the custom for many years in treating pernicious anemia.

When the transfusion is used to combat urgent symptoms one should not wait until relapse occurs, but the blood should be watched and if it falls only a little in cells and hemoglobin the operation should be repeated. (See Transfusion, Part III.)

In those types of pernicious anemia in which hemolysis is a dominant factor, in which the skin is yellow and the spleen enlarged, splenectomy may be indicated, particularly if the blood picture is one of fair bone-marrow activity since by this means it is hoped to arrest hemolysis and permit the bone-marrow to make up for the cells heretofore rapidly destroyed. (See Splenomegaly.)

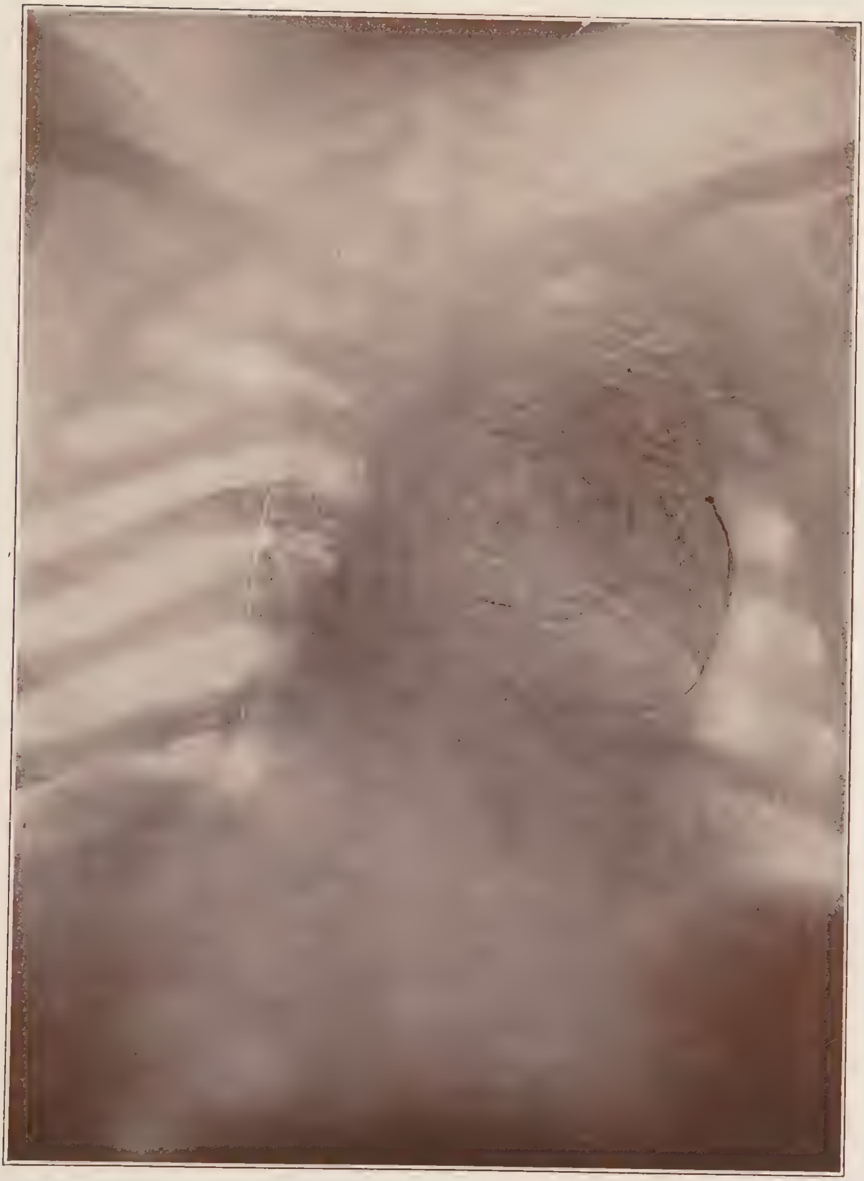
As in nearly all cases of pernicious anemia there is an absence of hydrochloric acid in the stomach full doses of the official dilute acid should be given with meals not only to aid digestion but to act as a gastric antiseptic. If possible ½ dram to 1 dram in sweetened water. In many cases the tongue is too sore to permit this.

Additional food should be good, well flavored, and varied, as well as easy of digestion. It should contain, as far as possible, the remedies needed by the system, such as bone salts and iron, and its ingestion may be accompanied by some red wine, such as port. Sunshine and fresh air are also essential.

ANEURISM.

The treatment of aneurism by drugs is not very successful, but is at least worthy of trial in all cases. Vascular disease resulting in such a lesion depends upon so many causes which may modify the treatment that the history of the case should be carefully considered. The most common causes are traumatism and syphilis, and very often injury is superimposed upon systemic infection. Whatever the cause of the disease may be, iodide of potassium is *par excellence* the remedy most apt to do good, even if it does not cure. The doses should be large, 30 to 60 grains (2.0–4.0) three times a day if the

PLATE IV



Skiagraph showing Wire Coiled in an Aneurismal Sac from a Patient in the Author's Wards.

Case reported by Dr. Beardsley.

patient will bear them, and the prognosis under this treatment is far more favorable if the cause be syphilis than if the disease be traumatic.

For successful treatment the recumbent position must be insisted upon, the patient being kept quiet in bed, changing his position as little as possible and confining himself to the most simple and easily digested diet, with entire avoidance of all stimulating substances either in the way of food or drink. Often it is best to adhere to an absolute milk diet. If the heart is excitable and irregular in its action, the vascular system irritable, and a high arterial tension is present, the circulation must be quieted by small doses of tincture of veratrum, say 4 to 8 minims (0.25–0.5) twice or thrice a day, but digitalis is not to be employed, since it increases the strain upon the aneurismal sac, although it quiets the irregular heart beat. Aconite may also be used in full doses. If the pain be very great—and it often is severe, particularly at night—opium is indicated, and sleeplessness should be allayed, not by full doses of morphine alone, but by morphine and chloral. All attempts to cure aneurism by the use of other drugs, unless syphilis indicates mercury, are useless when the lesion is thoracic or abdominal; and when it occurs in the extremities, as in popliteal aneurism, pressure or surgical measures are to be resorted to as the chief means of cure. If dyspnea is marked in thoracic aneurism, slight inhalations or "whiffs" of chloroform are sometimes useful, as is also morphine, given hypodermically in the dose of $\frac{1}{8}$ grain (0.008).

When a sacculated aneurism develops in the thoracic or abdominal aorta and is of good size, the best treatment is the introduction of platinum-gold or very fine silver wire, and the aiding of clot formation by electrolysis. The operation consists in pushing a hollow insulated needle into the sac, and then passing through it from 10 to 30 feet of fine gold-platinum or silver wire, fed from a spool, so that it snarls in the cavity. Great care must be taken to have so little platinum in the wire that it will snarl in the sac and not coil. The external end of the wire is attached to the positive pole of the battery, and a large clay electrode is attached to the negative pole and placed under the back. The current is gradually turned on and increased, during a period of fifty minutes, from 5 to 40 milliampères. The wire is then cut off, the needle removed, and the operation is finished. No accident during the operation has been reported when properly performed. It is absolutely contraindicated in fusiform aneurism. The first result is *relief of pain,* usually before the operation is completed. The second result is arrest of the growth, even when the skin over it seems about to give way. The third result is prolongation of life in hopeless cases for weeks or years. The writer has performed this operation a large number of times with satisfactory results, several patients having lived more than four years, although when the aorta was severely diseased the inevitably fatal result was postponed a comparatively short time, because the sac enlarged in another direction and ruptured or caused death by pressure on vital tissues. This procedure is to be employed in nearly every case of sacculated aneurism.

ANGINA PECTORIS.

The exact pathological changes existing in angina pectoris are by no means clearly understood, but without doubt many attacks are due to spasm of the bloodvessels, which results in distention of the left side of the heart, which organ is already dilated or enfeebled by disease. Often, too, the coronary arteries have undergone degenerative changes, thereby increasing the myocardial change or they may be suffering from spasm. Remedies which ordinarily relieve pain act too slowly or too feebly to be of service in angina pectoris, and even if successful would only relieve the symptom without removing the cause. The indication when the blood-pressure is high is to relax the vascular spasm, thus relieving the overburdened heart. As first pointed out by Brunton, the nitrites possess this power, and to him belongs the credit of first applying this class of drugs to this ailment. All the nitrites are useful, but the nitrite of amyl and nitroglycerin are the best remedies for the attack itself, and the nitrite of potassium or sodium for the intervening periods or when the paroxysm is prolonged. The reason for this lies in the fact that the sodium and potassium compounds are more stable than the other two compounds, are more slowly broken up in the body, and therefore more prolonged in their effects. In an attack a few drops of the nitrite of amyl should be given by inhalation from a handkerchief, or the nitroglycerin can be used in the dose of $\frac{1}{100}$ grain hypodermically. The dose of the sodium and potassium nitrites is 1 grain (0.03) five times a day, but all these drugs are, as a rule, efficient only when the arterial tension is high or the action of the heart labored.

It is often well to give the patient one of the following prescriptions to ward off a threatened attack or even to relieve a mild one already in existence:

℞—Spiritus chloroformi,
Spiritus ammoniæ aromatici . . . . . .āā f℥j (30.0).—M.
S.—A dessertspoonful (8.0) in 2 ounces (60.0) of water p. r. n.

Or,

℞—Spiritus chloroformi,
Tincturæ lavendulæ compositæ . . . . āā f℥j (30.0).—M.
S.—Same dose as above.

Whisky or brandy are useful in full dose, in hot water. Ether given hypodermically is often of service, or Hoffmann's anodyne may be used instead of ether by the mouth or hypodermically with good results.

If the nitrite does not relieve the pain, or if it cannot be used because of some contraindication, as in cases of low pressure, morphine must be given hypodermically in the dose of $\frac{1}{4}$ to $\frac{1}{2}$ grain (0.015–0.03), but it should never be given by the mouth under these circumstances, as its absorption will be too slow and its effects will come on after the pain has ceased.

The prevention of future attacks rests upon the elimination of all causes which can possibly produce a nerve-storm and cardiac irritability, and in the administration, if the arterial tension is high, of nitroglycerin or one of the other nitrites in full dose for long periods of time. (See Sodium Nitrite, Part II.) As a rule, these drugs have to be gradually increased in dose in order to maintain their effect. Full doses of one of the iodides, particularly Donovan's solution, continued over a long period of time are useful.

Many observers report excellent results in preventing or modifying attacks by the use of theobromine salicylate (see Part II) and particularly theophyllin in doses of 2 grains (0.1) four or five times in twenty-four hours. (See Theocin, Part II.) Perhaps the best results follow the employment four or five times a day of metaphyllin otherwise called Euphyllin-ethylendiamine 2 to 3 grains (0.1–0.3) given in tablet form preferably after food. All these remedies are, however, prone to disturb digestion.

Some patients develop on palpation one or more tender spots on the spine or the costal cartilages, and will get some relief from the application of a blister made by the application of cantharidal collodion.

In many instances, particularly if the patient is a relatively young man, these anginoid pains are best treated between attacks by the use of mercury and iodide of sodium as they are commonly due to a syphilitic aortitis. Arsphenamine is, in general contraindicated in such patients because it may produce an increase in the inflammatory process by the prompt destruction of many parasites and even if no immediate trouble follows the process of fibrosis is hurried. In such cases the aortic second sound usually has a peculiar ringing tone.

The following is a valuable prescription for use between the attacks if the heart is feeble and the tension high:

℞—Tincturæ digitalis	fʒj (4.0) vel fʒiij (12.0)
Tincturæ belladonnæ	f℥ss (15.0)
Spiritus glycerylis nitratis	♏xxiv (1.6) vel fʒj (4.0)
Tincturæ cardamomi compositi . .	f℥iij (90.0).—M.

S.—Teaspoonful (4.0) three or four times a day.

The diet should be moderate and easy of digestion, and salads, lobster, and similar articles of food avoided. If the patient is inclined to take exercise of a violent character he must be restrained, but, on the other hand, some gentle exercise may be permitted if it is possible to take it without precipitating an attack. When the attacks are frequent it is essential that the patient be given a rest of several weeks in bed and be protected from nervous and mental strains. This is important not only to avoid attacks but because in many cases the pain is due to aortitis, and by rest the pulsations of the blood against the aortic wall are decreased in number and force.

Tonics, fresh air, freedom from mental worry, and avoidance of exposure to cold are also necessary, and running for a car, or performing any act calculated to suddenly increase arterial pressure and cardiac work, is to be avoided.

In that form of heart pang occurring in nervous females, sometimes called pseudo-angina pectoris, 1 dram (4.0) of ether in ice-water or capsules will often abort the attack, or one of the prescriptions containing spirit of chloroform given above, or if the paroxysm is caused by dyspepsia and if the stomach be overloaded, the sufferer may be relieved by an emetic or the stomach-pump.

ANOREXIA.

Anorexia, or lack of appetite, is only a symptom of ill health, generally associated with debility or other systemic disorder, such as anemia, fever, and many exhausting diseases. It is best treated by a well-cooked and daintily prepared diet, the use of the bitter tonics, such as gentian, cardamoms, and the mineral acids, or by the use of one of the following prescriptions:

℞—Arseni trioxidi	gr. ½ (0.03)
Extracti nucis vomicæ	gr. iv (0.25)
Quininæ sulphatis	gr. xx (1.3).—M.

Fiant pilulæ, No. xx.
S.—One t. i. d. after meals.

Or,

℞—Acidi hydrochlorici diluti	f℥ss (16.0)
Tincturæ cinchonæ compositæ	f℥vj (180.0).—M.

S.—Dessertspoonful (8.0) three times a day, after meals, well diluted with water.

(For the use of other bitter tonics see Calumba, Quassia, Cardamom, and Nux Vomica. None of these drugs is suitable if there is any acute irritation or inflammation of the stomach or intestines.) (See Indigestion.)

APOPLEXY.

Up to a recent period it has been held that the high arterial tension of apoplexy was evil in its effect because it increased the extravasation of blood through the leaking vessel, and for this reason venesection has been commonly employed. Studies carried on by Kocher, in Berne, and by Cushing, this country, seem to indicate that this high arterial tension is an effort of Nature to drive sufficient blood into the cranium to maintain the circulation in the medulla, which would otherwise be impaired by the pressure of the extravasated fluid, for great intracranial pressure depresses the vasomotor center, and with its failure the vital centers nearby fail to receive an adequate supply of blood.

With our present knowledge it is probably best to use measures which are helpful and not radical.

Hot mustard plasters may be applied to the feet, or a hot mustard foot-bath be used if this is practicable. Ice in an ice-bag or wrapped in a towel may be applied to the head but these measures are but gestures at relief. If vomiting comes on care must be taken that the stertorous breathing does not draw into the lungs particles of the half-ejected food. The head must be kept high and the feet low. These are the methods to be used immediately after the rupture of the bloodvessel.

If there are signs of increased intracranial pressure the use of an intravenous injection of hypertonic saline solution (15 per mille that is 1.5 per cent) may be resorted to. (See Intravenous Injections.)

The objects to be sought, after the "stroke" has occurred and the hemorrhage has ceased, are the removal of the extravasated blood, the restoration of function in the paralyzed parts, and the prevention of secondary lesions consequent upon inflammation of the brain as a result of the injury to its substance. If the patient survives the attack, no drugs should be used for several days, until the clot in the ruptured vessel has become firmly fixed, unless symptoms of cerebritis arise, when vascular sedatives, such as aconite, must be pushed if the pulse is tense, and calomel administered in small doses, $\frac{1}{4}$ grain (0.015) every four hours. After the clot has firmly formed and has plugged the leak in the bloodvessel, we may proceed to take measures for the absorption of the exudate, the chief measures consisting in the use of iodide of potassium in as large doses as the patient will bear without the production of iodism. This drug should not be resorted to until two or three weeks have elapsed after the attack. Mercury may also be given, particularly if an old syphilitic infection is the underlying cause of the vascular rupture.

In order that the muscles of the extremities may not waste and become powerless from disuse, passive exercise, rubbing, and, if possible, massage, must be resorted to. Electricity may be applied to them in the form of the slowly interrupted current, and strychnine may be used hypodermically or by the mouth as a stimulant to the trophic centers in the spinal cord. None of these measures is to be employed if any inflammation exists in the brain, as they will increase the cerebral disorder, and at least three weeks should elapse after the attack before they are resorted to. (See Strychnine.)

Electricity applied to the head is useless, as the current does not go through the brain, but around the skull by means of the scalp.

A very careful diet is to be maintained. Meats are to be used very sparingly, the bowels maintained in perfect regularity, and no wines are to be taken nor any stimulants used lest they cause a second rupture of the weakened vessel in the brain.

Apoplexy must be carefully differentiated from acute alcoholism and opium-poisoning, which it much resembles. (See Alcohol.)

If respiration fails, nothing can be done with much advantage, but atropine or strychnine may be given hypodermically. The use of electricity to stimulate the phrenic nerve and diaphragm when respiration fails is a remnant of senseless medical practice, and is particularly useless in apoplexy. (See Asphyxia.)

Above all things, stimulants are contraindicated during the acute attack, even though the pulse fails, as they increase the hemorrhage into the brain.

If the symptoms of apoplexy are produced by an embolus or thrombus, bleeding is useless, and it may be harmful by decreasing arterial pressure and thereby delaying the establishment of collateral circulation. This is also true of circulatory sedatives.

APPENDICITIS (ACUTE).

It is to be remembered that many cases which years ago would have been called idiopathic peritonitis are now recognized as arising primarily from inflammation of the appendix vermiformis. For this reason it is incumbent upon every physician who is called to see a case of abdominal, or right-sided lower thoracic, pain to examine carefully into the condition of the appendix. No routine treatment for appendicitis can be followed, as each case possesses distinct individuality. There are many surgeons, holding extreme views, who assert that the mere presence of appendicular inflammation for a few hours renders an extirpation of this organ necessary. There is good reason for this view because very frequently the diseased organ is removed before it has done harm or one is startled at finding on opening the belly that the appendix is just about to perforate or rupture or is already gangrenous. For these reasons there are doubtless many cases in which the physician postpones consultation with a surgeon until it is too late to save the patient. On the other hand, many cases of acute appendicitis get well without operation. (See below.)

It is unwise to give a purgative, since the *caput coli* never contains feces in any quantity, and, furthermore, in those fairly severe cases which demand operation at once the possibility of perforation of the appendix, with escape of the contents of the bowel into the peritoneal cavity, is always to be remembered. Furthermore, if purgatives are not used before operation the occurrence of so-called gas pains afterward is usually avoided. Deaver says there are "four Ps"—Purgatives, Peritonitis, Perforation, Postmortem. Intestinal rest is essential, which is the probable explanation of the confidence of our forefathers in opium in peritonitis.

If the patient shows definite tenderness on pressure over McBurney's point, has a quickened pulse-rate with distinct, but not necessarily marked, fixation of the abdominal wall on the right side, and has a leukocytosis of 15,000 to 25,000, even if the temperature is not raised, advise operation if a surgeon skilful enough to do it well and experienced enough to meet unexpected complications can be had. If there is a history of severe pain followed by relief without the use of opiates, operate, because the relief is probably due to gangrene or perforation.

Also recall that a retro-colic appendix may cause pain which is posterior or high up.

If the patient has been ill some days, and peritonitis has developed, operation is to be postponed until the inflammation subsides or is localized, and the treatment described under Peritonitis instituted. Sometimes it is best to postpone surgical interference in mild cases until after the acute attack is over, but the difficulty lies in the fact that some cases presenting mild symptoms are actually severe and slough early. If there is a history of other attacks it is best to operate, even if the symptoms are mild, although little or no fever, absence of rapid pulse, absence of rigidity and a low leukocyte count may counsel delay.

A good rule is get in quickly or stay out until things quiet down.

In all cases of appendicitis in which operation is refused or in which it is not possible to get the aid of a competent surgeon, the method to be followed is briefly as follows: The patient is to be put to bed and absolute rest on the back insisted upon. He must not rise to the sitting posture even for defecation or urination. No food or drink should be given for twenty-four or thirty-six hours, in order that the greatest degree of intestinal rest may be attained. If constipation has been present so that the bowels are loaded with feces, it is best to unload the colon by a rectal injection. After the bowels have been moved, sufficiently large doses of opium or morphine are to be given to relieve pain *if it is severe enough* to be agonizing. The doses should be so small as to only "take the edge off the pain," but they must not stupefy the patient, so that he fails to give clear answers to questions or is so comfortable that in his ignorance he declines surgical aid. Hypodermoclysis or proctoclysis should be resorted to when the tissues need fluid. (See Peritonitis.)

The whole question as to operation depends upon the severity of the inflammatory process, the medical attendant's ability to determine its severity, the state of the patient (see Peritonitis) and not least, upon the ability to obtain first-rate surgical skill in the operator. Richardson believed that if the operator is inexperienced the patient's chances are best from medical treatment.

In this connection it is of interest to consider the plan instituted by Ochsner, and which has given such results as to demand attention. The determination of the character of the treatment to be carried out rests upon the condition of the appendix at the time the patient is seen.

His views are best described as follows:

1. Patients suffering from chronic recurrent appendicitis should be operated on during the interval.
2. Patients suffering from acute appendicitis should be operated on as soon as the diagnosis is made, provided they come under treatment while the infectious material is still confined to the appendix, if a competent surgeon is available.
3. In all cases of acute appendicitis without regard to the treatment contemplated the administration of food and cathartics by mouth should be absolutely prohibited and large enemata should never be given.
4. In case of nausea or vomiting or gaseous distention of the abdomen, gastric lavage should be employed.
5. In cases coming under treatment after the infection has extended beyond the tissues of the appendix, especially in the presence of beginning diffuse peritonitis, conclusions 3 and 4 should always be followed until the patient's condition makes operative interference safe.
6. In case no operation is performed, neither nourishment nor cathartics should be given by mouth until the patient has been free from pain and otherwise normal for at least four days.
7. During the beginning of this treatment not even water should be given by mouth, the thirst quenched by rinsing the mouth with cold water and by the use of small enemata. Later small sips of very hot water, frequently repeated, may be given, and still later small sips of cold water. There is danger in giving water too freely.
8. All practitioners of medicine and surgery, as well as the general public, should be impressed with the importance of prohibiting the use of cathartics and food by mouth, as well as the use of large enemata, in cases suffering from acute appendicitis.
9. It should constantly be borne in mind that even the slightest amount of liquid food of any kind given by mouth may give rise to dangerous peristalsis.
10. The most convenient form of rectal feeding consists in the use of 1 ounce of one of the various concentrated liquid predigested foods, dissolved in 3 ounces of warm normal salt solution, introduced slowly through a soft catheter inserted into the rectum a distance of 2 or 3 inches.
11. This form of treatment cannot supplant the operative treatment of acute appendicitis, but it can and should be used to reduce the mortality by changing the class of cases in which the mortality is greatest into another class in which the mortality is very small after operation.

To this plan the author would add the use of normal saline solution by hypodermoclysis, with the object of allaying thirst and flushing the kidneys. (See Enteroclysis in article on Peritonitis, Important.)

The patient should be placed in the so-called Fowler's position, that is semi-recumbent, and kept there to aid in the prevention of the spread of infection toward the diaphragm.

ASPHYXIA.

When practising artificial respiration in cases of asphyxia the so-called "prone-posture method" of Schäfer, or Sylvester's, method should always be employed. (See Oxygen, Part II.)

Schäfer's method consists in placing the patient so that he lies on the anterior aspect of the body, with the face turned to one side. The physician then kneels at one side or astride of the patient and, placing his hands on the floating ribs, so that the heel of the hand rests at about the posterior axillary line, presses upon the thoracic walls, which drives out the air from the chest and also any fluid or mucus which may be blocking the upper respiratory passages. The pressure is then removed and the natural elasticity of the chest wall causes inspiration. The movements should be made about fourteen times a minute.

Sylvester's method consists of laying the patient on some hard, flat surface, kneeling above his head, and then, after grasping the arms at the elbows, bringing them upward and outward, so that they follow the plane on which the body is extended. This movement causes expansion of the chest, or *inspiration.* After a moment's pause the arms are lifted up and brought toward one another, and then while still approximated, pushed down near to their original position upon the floating ribs, upon which they are pressed. This last movement drives out the air from the chest, or causes *expiration.* These movements should be at the rate of from sixteen to twenty per minute, about that of normal respiration, and be persisted in for at least forty-five minutes, even though the case seems hopeless, as cases have recovered after as long a period of apparent death as one hour. While these movements are being carried on the patulousness of the upper air-passages is to be maintained, if possible, by the measures described below. The disadvantages of Sylvester's method are that the posture of the body does not drain the upper respiratory passage of fluid and, further, it rapidly exhausts the operator, since the arms of an unconscious patient are very heavy and difficult to move.

The Proper Position of the Head.—In some researches made by Dr. Martin and the writer the following rules regarding the position of the head, neck, epiglottis, and tongue were formulated: The fingers are passed behind the angles of the lower jaw and the latter is pressed forward; this elevates the epiglottis and the base of the tongue about a quarter of an inch from the postpharyngeal wall. Extending the head and pushing it forward, so that the neck makes an angle of forty-five degrees with the plane of the table, draws the base of the tongue and the hyoid bone far forward, this motion being

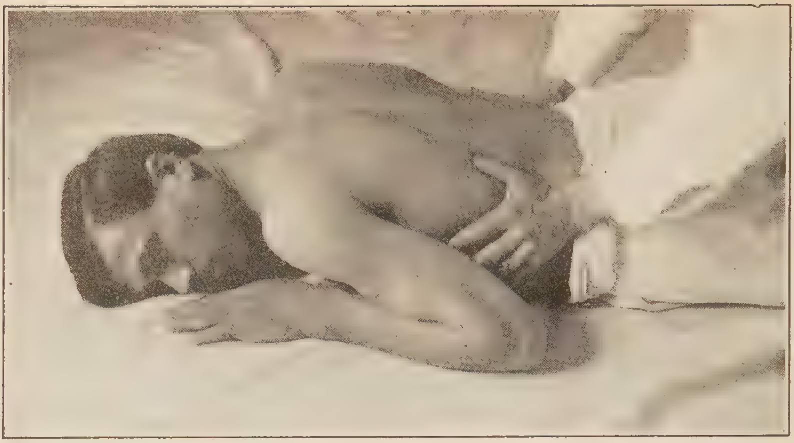


Fig. 109.—Artificial respiration by Schäfer's method. By this means fluids and mucus are more readily expelled from the upper respiratory tract than in the older methods.

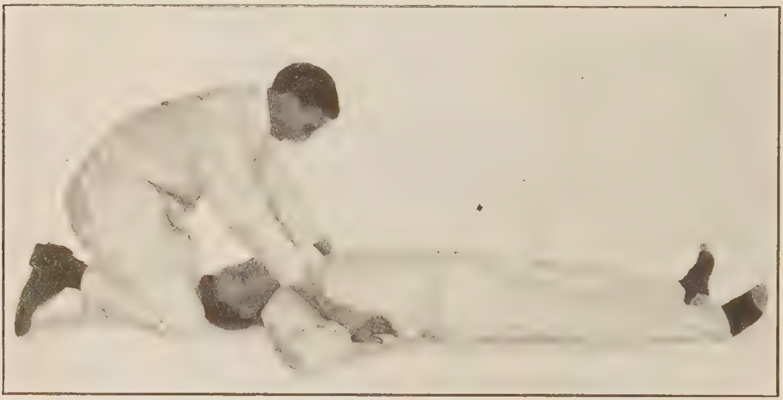


Fig. 110.—Sylvester's method of artificial respiration. First movement: the patient's arms are placed at right angles to the trunk, the elbows resting on the floor, to expand or inflate the chest.

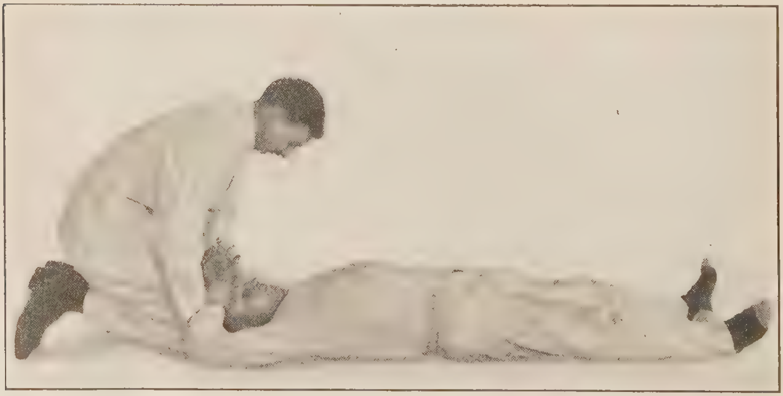


Fig. 111.—Sylvester's method of artificial respiration. Second movement: the patient's arms are drawn toward the physician, in order to expand the chest still further.

at the same time imparted to the epiglottis, so that the latter stands upright and is separated from the posterior wall of the pharynx by an interval of about an inch. By tightly closing the jaw the antero-posterior space is still further increased (Fig. 114).

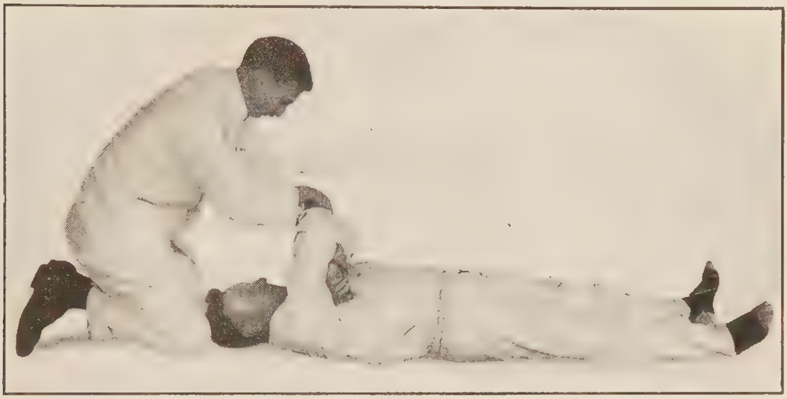


Fig. 112.—Sylvester's method of artificial respiration. Third movement: the patient's arms are raised and the elbows approximated to contract the chest.

A very useful method of treating asphyxia is that of Laborde, by rhythmic traction on the tongue. The tongue is grasped with forceps and pulled well forward and upward from ten to fourteen times a minute until voluntary respirations occur. The sensory nerves of the tongue carry impulses to the phrenic center, which in turn causes the diaphragm to contract. A very large number of recoveries from

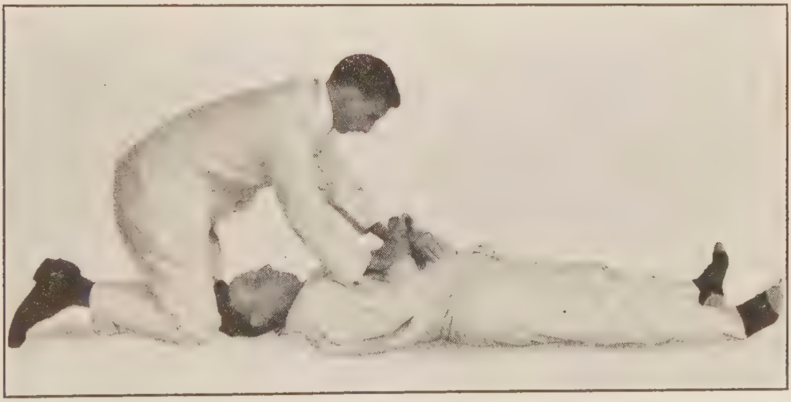


Fig. 113.—Sylvester's method of artificial respiration. Fourth movement: the patient's elbow and forearms are pressed forcibly upon the floating ribs to expel the air from the chest.

apparent death as a result of its use renders this method most worthy of trial.

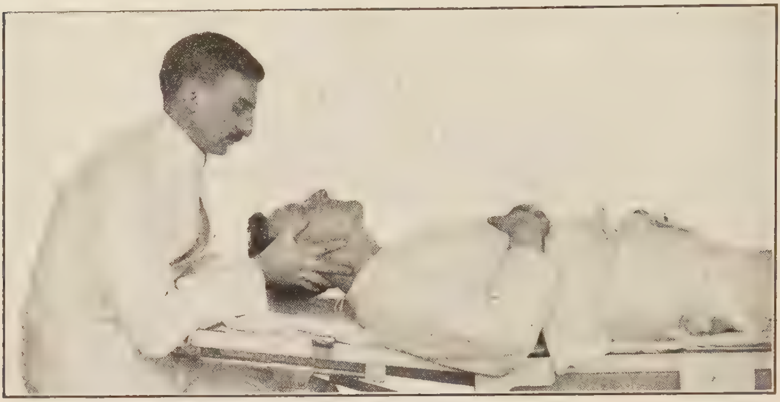


Fig. 114.—Showing the attitude in which the head should be held to permit the easy passage of air through the glottis. This position raises the epiglottis and lifts the soft palate from the tongue. (Martin and Hare's method.)

The absurdity of the application of the rapidly interrupted electric current to the phrenic nerve is not alone dependent upon the points we have named. (See Ether.) It has been proved by careful observation on the part of Dr. Edward Martin and the author that the application of the electrode over the phrenic nerve in the neck may

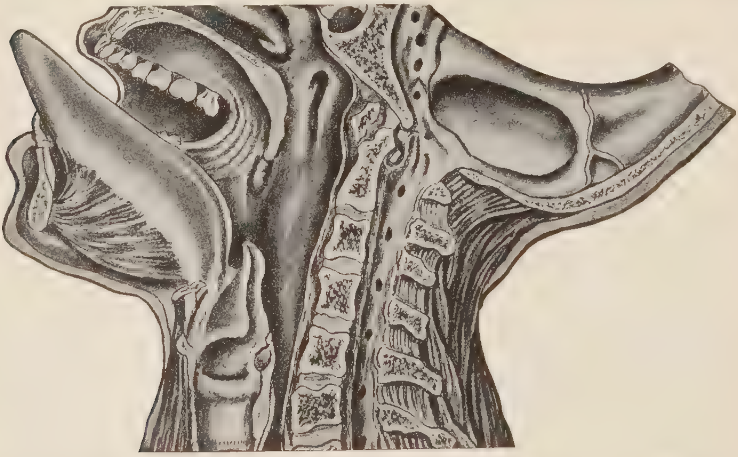


Fig. 115.—Illustrating how upward traction on the tip of the tongue draws the epiglottis away from the glottic opening and permits free ingress of air. It also shows how letting the tongue fall back in the mouth in anesthesia would close the air-passages and permit the epiglottis to interfere with breathing. (From a research by Dr. Martin and the author.)

cause cardiac arrest through diffusion of the current to the vagus nerve, and Griswold reached conclusions of an identical character in 1885.

If electricity is used, it should be employed solely as a peripheral irritant, with the subject of arousing the patient, as would the dry electric brush.

ASTHENOPIA.

Asthenopia, or weak sight, a term formerly much employed to describe a condition characterized by lack of visual endurance, blurred vision, eye pain and headache. It depends, as was originally demonstrated by Donders, upon exhaustion of the power of accommodation in cases of refractive error, usually hypermetropia, or upon imbalance of the external ocular muscles. The former is sometimes called *accommodative asthenopia,* and the latter *muscular asthenopia.* The treatment of these conditions requires the prescribing of proper lenses, combined, if necessary, with prisms and with systematic exercise of the ocular muscles. Stubborn asthenopia may be part of the symptomatology of general functional disturbances, metabolic disorders, toxemias of focal injection, etc., hence the necessity of investigation and treatment from these standpoints.

Another form of asthenopia is termed *neurasthenic asthenopia,* or *retinal anesthesia,* and presents a number of eye-symptoms in connection with a general depression or debilitated state of the nervous system, the eye itself, however, being a healthy organ. The chief symptoms are fluctuation in visual acuteness, rapid disappearance of objects looked at, contraction of the field of vision, imperfect retinal images, often associated with dread of light. Correction of refractive error is an essential procedure, but is not sufficient. The patient requires the same general treatment that would be applied to any neurasthenic case. (See Rest Cure, Part III.)

ASTHMA.

Asthma is one of the most difficult symptoms to treat successfully with which the physician has to deal.

The condition in all its forms depends upon interference with the free entrance to and exit of the air from the lungs, and this is generally, if not always, dependent upon a spasm of the muscular fibers in the walls of the bronchial tubes with an associated swelling or hyperemia of the bronchial mucous membrane. Both of these states are probably present in varying degree in all cases.

The spasm has been proved by Longet, Williams, Romberg, Paul Bert, Bierner, and more recently by Sandmann, to be due to a neurosis of the pneumogastric or vagus nerve, and the swelling of the mucous membrane has been seen by Stoerk and others. Thus two schools of teaching concerning the pathology of this disease have been formed, when a little attention to the physiology of the subject would at least show that no difference need exist, for the vagus nerves govern not only the muscular fibers, but also the bloodvessels of the bronchial tubes. The discovery of Michaelson that injury of the recurrent laryngeal nerves causes catarrhal inflammation of the bronchial tubes, particularly those of the upper lobes, renders the analogy between acute asthma and laryngeal spasm, which has been spoken of by many writers, still more interesting.

One other step remains for a thorough understanding of the manner in which the disease is produced. Gastric, dyspeptic, or intestinal asthma arises from indigestion, as its name implies, and is caused by the irritation of the afferent filaments of the vagus in the walls of the stomach and intestine, thereby causing reflexly a contraction and hyperemia of the bronchial tubes. In a similar reflex manner abnormal conditions of the nasal mucous membranes in general may result in an asthmatic attack. There is also some evidence that small collections of pus in the nasal sinuses may reflexly cause asthma, or by the absorption of the pus the asthma may be a form of anaphylaxis.

Closely associated with this type is that which is induced by sensitiveness of the patient to other forms of proteins than those derived from pus such as the proteins derived from pollens (see Pollen Proteins) and food proteins which may come from the animal or vegetable kingdom. Many cases of asthma can be relieved or cured by discovering the source of the protein to which the patient is sensitive and avoiding it, or by a course of treatment with small doses we may develop an immunity. This book is not the place to discuss this subject *in extenso*. The point to be remembered is that asthma is a symptom not a disease, and that while relief is to be found more or less in drugs the cure rests in discovering, if possible, the cause.

Having obtained some idea of the cause of an attack, let us turn to the treatment of the affection.

As soon as the patient is seen when threatened or in an attack, 5 to 10 minims (0.3–0.65) of adrenalin solution (1 to 1000) should be given hypodermically; in other cases the same amount of pituitrin may be used. Ephedrin hydrochloride or sulphate may be tried but is not so efficient as a rule. They all act by relaxing the bronchial muscular fibers. If they fail, which is rarely the case, morphine hypodermically in the dose of $\frac{1}{6}$ to $\frac{1}{4}$ grain (0.01–0.015), alone or in combination with atropine, should be resorted to.

One of the most serviceable remedies in asthma is belladonna, which, as has been pointed out when that drug was studied (see Belladonna), exercises in medicinal dose a decided sedative and depressant influence on the peripheral filaments of the vagus nerves, not only so far as the heart is concerned but also through the pulmonary fibers, upon bronchial secretion, which is always diminished by the drug, probably by its vagal influence.

It is evident, therefore, that the use of belladonna or atropine, although originally employed in an empirical manner, rests upon a rational basis, and as the physiological action of stramonium, hyoscyamus, and similar members of this group is nearly identical with that of belladonna, their influence for good is also explained. The experiments of Ott prove that lobelia is a peripheral pneumogastric depressant, and those of Rosenthal and the author likewise showed that tobacco has a similar effect. The same is also true of nitrite of amyl and the other nitrites, which also relax unstriped muscular fiber. We have before use, therefore, a list of the most efficacious and best antiasthmatics, all of them being depressant to the peripheral vagi.

The use of amyl nitrite by inhalation, 3 to 6 minims (0.2–0.4) on a handkerchief, is invaluable in many cases, and it rarely fails to relieve the spasm. Owing to the engorgement of the heart consequent upon the embarrassment of respiration, this nitrite must be used with care. A hypodermic injection of $\frac{1}{100}$ grain of nitroglycerin is better.

The other remedies commonly employed are chloroform by inhalation, which relaxes the spasm of muscular fiber by its local influence, and morphine, which acts as a nervous sedative, prevents reflex irritation, and quiets the patient, acting at the same time as a heart stimulant and unloading the engorged cardiac cavities. Chloroform is, however, not devoid of danger, particularly in chronic cases which emphysema and a weak right heart. The relief obtained by the inhalation of the fumes of nitrate of potassium, Sée asserts, depends upon the formation of the protoxide of nitrogen and carbonic acid gas, which act as local anesthetics.

In some cases a very useful treatment is the smoking of nitre-paper cigarettes, which are prepared, before rolling, not only by soaking the paper in a solution of nitrate of potassium (see Nitrate of Potassium), but also by dipping them, after drying them, in tincture of belladonna or stramonium, and allowing the alcohol to evaporate from the paper while it is hung in the air.

The following prescription often produces excellent results for the prevention of an oncoming attack, or to relieve one already in existence. Patients do not find the fumes disagreeable, or if so, are compensated by the relief obtained. The method of using this prescription is to place a teaspoonful of it on a plate, ignite it with a match and lean over it so that the fumes are readily inhaled.

℞—Pulv. stramonii	℥iv	(120.0)
Pulv. lobeliæ	℥ss	(15.0)
Potassii nitratis	℥iv	(120.0)
Brown sugar	℥v	(150.0)

S.—Granulate with hot water.

Another remedy for the relief and cure of asthma is euphorbia pilulifera, the fluidextract of which may be given in the dose of $\frac{1}{2}$ to 1 dram (2.0–4.0) once, twice, or thrice a day. (See Euphorbia Pilulifera.)

The author finds the following formula very useful in asthma:

℞—Sodii iodidi	gr. ij (0.12)
Potassii bromidi	gr. ij (0.12)
Fluidextracti euphorbiæ piluliferæ	♏iij (0.2)
Nitroglycerini	gr $\frac{1}{200}$ (0.0003)
Tincturæ lobeliæ	♏iv (0.25).—M.

Fiat tabella vel capsula No. 1.
S.—From 1 to 6 four times a day.

If desired, this formula may be given in the form of an elixir.

It will be seen that each ingredient of this recipe has a different action. The action of the iodides in asthma is well known, as is also that of the bromides. The euphorbia pilulifera has been found useful in asthma empirically. The nitroglycerin depresses the peripheral ends of the vagus nerves, and acts as a stimulant to the heart when engorged with blood by removing the inhibitory action of the vagus and relieving the bloodvessels elsewhere. The tincture of lobelia acts as a depressant to the vagus also.

A valuable prescription for asthmatics to take between the attacks, particularly in those cases which have symptoms of cardiac strain is one calling for digitalis. (See Digitalis, Part II.)

Sometimes a cup of strong coffee taken at the beginning of a paroxysm will abort it.

Sometimes tobacco may be smoked, and it is particularly efficacious in those who are not accustomed to its constant use.

Lobelia if employed should be used in full emetic dose, 2 drams (8.0), in the form of the tincture if an attack is imminent. If an attack is feared, 20 minims (1.3) of the tincture every four hours may be given if the heart is in good condition.

A treatment of asthma which is very successful when it arises from a focus of irritation in the nose consists in the application to the sensitive spot at the onset of the attack of the following solution by means of an application or spray:

Aquæ destillatæ		f℥j (30.0)
Procainæ hydrochloridi		
Ephedrinæ hydrochloridi	āā q.s. ad.	0.3 per cent

If this solution is applied to the right spot and the other directions given are carried out very rapid relief will often be obtained. Unfortunately, we cannot readily separate those cases which are due to nasal disease and those produced by other causes, and in consequence this treatment when tried for the first time in a given case is purely experimental unless we can discover some hyperesthetic patch in the mucous membrane.

The curative treatment of asthma in many cases to a very large extent rests upon the use of iodide of potassium, and in the careful regulation of the diet and bowels, particularly if the trouble seems to be dependent upon indigestion. As the attacks are generally nocturnal, the evening meal should be taken early, be light and easily digested, and tea and coffee should be avoided at this time. The patient should avoid dusty streets and live in the open air as much as possible, and a damp atmosphere is usually preferable to a dry one, provided it is not cold. This rule is subject to many variations, and each case will be found to be a law unto itself. Each patient must try different climates until the proper one is found. Arsenic may be used, particularly if the mucous membranes are below par, and a dose of bromide of potassium or sodium, 30 grains (2.0) one-half hour before retiring may be of service. (See Pollen Proteins.)

Grindelia robusta is largely used as a prophylactic in the dose of 10 to 30 minims (0.6–2.0) of the fluidextract three times a day.

Inhalations of oxygen are valuable if the cyanosis is extreme. (See Oxygen, Part II.)

In many cases great relief will be given by the use of the bronchitis tent. (See Bronchitis.) If there is not free secretion in the bronchial tubes.

If a chronic bronchitis is present, or if the roentgen-rays reveal enlargement of the peribronchial lymph nodes, quartz light therapy is often very useful and in some cases in which a blood analysis reveals a low calcium content below the normal 9 to 11 milligrams per 100 cc., the use of calcium lactate in 5 to 10 grains (0.3–0.65) doses three times a day is advantageous. (See Calcium, Part II.)

In those cases in which the presence of nasal polypi, a deflected septum, or enlarged turbinates, or diseased tonsils are present, these causes must be removed before a cure can be obtained. In other instances arsenical wall-papers are the cause of the trouble. In all cases of asthma the physician should from time to time examine the urine and the heart to determine if the attacks are due to disease of the kidneys or to congestion from cardiac failure.

BED-SORES.

Bed-sores depend upon disturbances of nutrition resulting from pressure exercised in such a manner that the local circulation is interfered with at a time when the vitality of all the tissues is depressed by disease or injury. In most instances the part involved becomes chafed by creases in the sheets, by crumbs of food, or by moisture from the discharges of the rectum and bladder. Bed-sores can usually be avoided by cleanliness unless they are dependent upon disease of the trophic nervous system.

The chief indication is to prevent the trouble by careful nursing and cleanliness, which should be supplemented by measures devoted to the hardening and improving of the nutrition of the skin covering the parts where the sores are apt to appear, as over the buttocks and sacrum. To permit of a good supply of blood, the patient should be turned on one side or the other every few hours and the skin of the part which has been pressed upon rubbed thoroughly with a dry towel to cause a healthy circulation and interchange of the nutritive juices. Salt and alcohol, 2 drams (8.0) to the pint (480.0), may be rubbed over the skin, and tincture of gambir or the dilute solution of the subacetate of lead applied to harden it. If this is not used, a mixture of alum and spirit of camphor is useful, made by adding 1 ounce (30.0) of powdered alum to the whites of 4 eggs and mixing this with 2 ounces (60.0) of the camphorated spirit. Where the skin is very red and angry-looking, but still intact, a solution of nitrate of silver of the strength of 20 grains to 1 ounce (1.3–30.0) is to be thoroughly painted over the spot. All these remedies act by hardening the skin through their astringency, or by acting as sedative astringents to the inflamed but relaxed capillaries of the part.

When a bed-sore is developed, measures must be taken for its cure and the prevention of its spread. With this object in view the body must not rest on the part affected if this can possibly be avoided, and in order that the sore may be protected and the pressure equalized, a large piece of soap-plaster, with its edges deeply incised to make them pliable, should be applied after the sore has been thoroughly washed out by means of a swab or syringe filled with a 1 to 5000 solution of bichloride of mercury, and afterward dusted with iodoform or with chloretone and boric acid in equal parts. Sometimes large squares of lint thickly covered with zinc ointment are serviceable in lieu of the soap-plaster. If the sores spread and burrow through the parts, the sinuses should be freely opened and irrigated with peroxide of hydrogen, all dead tissues being cut away to avoid sepsis.

Nitrate of silver in the strength of 20 grains to 1 ounce (1.3–30.0) may also be used locally as the patient recovers if the ulcers seem sluggish. A *smooth* slip-sheet should always be placed under the buttocks. If possible, supportive measures and an increased amount of predigested food should be given if the sloughs are large. The internal use of iron is particularly valuable in the form of the tincture of the chloride in full doses (say 20 minims [1.3]) every four hours.

BILIOUSNESS.

This is a term used to designate a state which presents different symptoms in different cases, but always includes languor, headache, or dizziness, perhaps some yellowing of the skin and conjunctiva, and a general sense of atony, mental depression, and discomfort. It depends not upon an excessive secretion of bile, but upon some perversion of the functions of the liver or the retention of bile in the bile-ducts. Further than this, most of the symptoms do not depend directly upon the changes in the bile, but upon failure of proper digestion in the stomach and intestine, coupled with the development of toxic decomposition products of various kinds. The stomach, intestine, liver, pancreas, and their juices all form a complex interwoven chain of function in which if one link breaks the entire chain becomes disturbed. The entrance into the stomach of certain foodstuffs which are either ill-prepared or improper for gastric digestion rapidly causes the development of active fermentation, with the formation of lactic and butyric acids, which irritate the gastric mucous membrane, and thereby bring about a faulty gastric secretion of mucus, which makes still further trouble.

By the same means the circulation of the stomach is disturbed and becomes abnormal, and the intestine, liver, and pancreas receive reflex irritation to which they are not normally exposed. Further than this, the irritated stomach fails to convert its contents into peptones and the general features of chyme, and too early or too late drives out into the duodenum a mass of semi-digested and fermenting material entirely unfit for intestinal digestion and absorption, thereby disordering the functions of these parts still further at a time when they are not prepared for the reception of any food. The secretion poured out by the different glands varies from the normal; the alkaline juices are not able to overcome the normal acid of the gastric juice plus the lactic and butyric acids; and finally the reaction of the intestine becomes acid instead of alkaline, with resulting irritation and secretion of morbid juices and mucus. The trouble when existing in the stomach gives rise to headache and discomfort, a bad taste in the mouth, and perhaps pain, and is followed by fever, languor, jaundice, and flatulence when the intestine is affected.

The cause of these symptoms rests upon the fact that, while gastric juice and bile are antiseptic, pancreatic juice mixed with food undergoes rapid decomposition, with the development of products of decomposition such as skatol and indol and a large number of poisonous alkaloids. Normally, these are not allowed to form, owing to the presence of antiseptic bile, which also hurries on the absorption of the fats; but if the bile is retained in the ducts, its excretion is impaired and its constitution altered by the disorder of the liver which results reflexly from the gastric and intestinal irritation. Unfortunately, the complication does not cease at this point, for the liver in health has other functions to fulfil, one of the most important of which is the arrest and destruction of all poisons of an organic character which come to it from the stomach and bowel. Not only are decomposition products destroyed by it, but all the vegetable alkaloids are rendered innocuous if present in ordinary amounts.[1] The disorder of hepatic function therefore permits the entrance into the general circulation of these substances, which are very various as regards their powers and effects. Thus, Brunton has pointed out that one of these compounds closely resembles curare, in that it poisons the peripheral ends of the motor nerves, and thereby is at least partly responsible for the muscular relaxation and languor often seen in patients suffering from so-called "biliousness." Other substances act as do digitalis, atropine, muscarine, and picrotoxin, and the number of these various compounds is infinite.[1]

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[1] See studies of Schiff, Lautenbach and many others, including Ludwig and Schmidt-Mulheim.

It is impossible to give space to a further consideration of these poisons, but what has been said shows clearly that "biliousness" only expresses a state in which absorption of the bile is not the chief cause of the symptoms, but that other poisons are at work. The methods of treating biliousness are therefore not to be considered as depending upon some regular routine, but upon a study of the case and its symptoms.

Very frequently, after several days of minor discomfort, the disorder culminates in a severe sick headache, after which vomiting comes on and relief is soon obtained. The manner in which vomiting does good is very evident. It compresses the liver and expels inspissated bile by the compression exercised by the abdominal walls and diaphragm in the effort of vomiting, and thoroughly excites to normal secretion the torpid glands of the stomach and intestine. The vomiting or lavage also rids the stomach of the fermenting masses and bacteria contained in them, and renders the alimentary canal more pure. This purity may be increased by giving draughts of plain hot water or hot water containing a few grains of bicarbonate of sodium.

When it becomes evident that an attack is about to begin—that is, when constipation, slight drowsiness, or languor after meals shows the tendency present—one of two drugs should be used, either podophyllin if the stools be dark, or calomel if they be light-colored: $\frac{1}{6}$ grain (0.01) of the former to an adult is generally enough, or 1 grain (0.06) of calomel divided into six powders, one of which is to be taken every fifteen minutes, is a good dose, to be followed in four hours by a saline. If the attack is sudden in its onset, no time is allowed for these hepatic stimulants, and a saline purge should be used in a good-sized dose at once because it sweeps the poisonous matters out of the gut before complete absorption can occur, and aids in restoring the normal intestinal alkalinity.

The prevention of "biliousness" depends upon the maintenance of a normal, easily digested diet, upon the formation and excretion of normal bile, and the prevention of fermentation and decomposition in the alimentary tract.

The term "normal diet" is a very elastic one, and varies with each case. While certain forms of food are generally considered good or bad, easy of digestion or difficult of assimilation, it nevertheless remains a fact that many of the simplest foods are capable of acting as poisons in susceptible persons. A large number of persons cannot take milk or eggs because their digestion of these substances is faulty, and the writer is cognizant of one case where lobster salad can be eaten at bedtime without discomfort, while an egg at breakfast will cause a severe headache or pain in the belly. Coffee is often the cause of biliousness. Fatty foods are to be avoided. Rules as to diet must not be "ironclad," but based on observation in each individual case.

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[1] See the researches of Schweringer, Zuelzer and Sonnenscheim, Bence Jones, Dupré, Rörch and Fassbender, Brieger, Schmiedeberg and Harnach.

By far the best means of maintaining hepatic activity in cases where this organ is torpid is horseback exercise, particularly if the exercise is taken on a trotting horse, as the jolting of the liver keeps the chain of digestive functions active and prevents the secretions from becoming clogged. Along with this exercise massage of the hypochondrium and belly-walls is useful, and the movements of stooping over, bending from side to side, and bending backward with the feet close together, are of value. (For movements see Inhalations, Part III.)

The use of the pure (strong) nitrohydrochloric acid in these cases in the dose of 5 minims (0.3) three times a day in $\frac{1}{2}$ tumblerful of water is invaluable, and the fluidextract of stillingia in the dose of 20 minims (1.3) is of service, as is also the solid extract of euonymus in the dose of 3 grains (0.2).

In some instances the best plan of treatment is the employment of colonic lavage since this measure not only removes accumulated fecal matter in the colon but reflexly tends to increase the flow of bile.

The knowledge of the action of many of the poisonous materials formed in the alimentary canal renders it possible for us to relieve the patient by other means than those which may be generally resorted to when the attack is present. Thus if the pulse be slow and full, the arterial tension high, and there is throbbing in the head, with frontal headache, the toxine representing digitalis may be antidoted by the use of aconite. If nervousness and irritation are present, the bromides and chloral may be used.

The use of caffeine in the headaches of biliousness nearly always makes them worse, particularly if the headache is due to overindulgence in coffee. (See Headache.)

If the face is flushed, a mustard plaster or dry cup to the nape of the neck may be used, and a hot foot-bath is often of service.

In cases where the bilious attacks are associated with catarrh of the stomach, intestines, or bile-ducts, chloride of ammonium, in 10-grain (0.65) doses, three times a day, is very useful, as is also the protiodide of mercury, when triturated with sugar of milk, in the dose of $\frac{1}{60}$ to $\frac{1}{40}$ grain (0.001–0.0015) three times a day. Frequently the use of salol or acetylsalicylic acid in 10-grain (0.6) doses, three times a day, does much good in these cases, acting as an intestinal antiseptic. (See Salol.) When the condition is persistent the gall-bladder should be examined by the roentgen-rays aided by the use of tetraiodophenolphthalein (see Part II) or the physician should resort to duodenal lavage.

BLEPHARITIS.

Blepharitis is divided clinically into an ulcerative and a non-ulcerative variety. The indication of prime importance in the treatment of this affection is the removal of the scabs and crusts before the application of the local remedies. This may be accomplished by the use of alkaline solutions, bicarbonate or biborate of sodium (8 grains to the ounce [0.5 to 30.0]), or daily gently scrubbing of the lid margins with the lather of a good neutral soap. The salves that have met with the greatest success are yellow oxide of mercury, 1 grain (0.06), vaseline, 1 dram (4.0), dilute citrine ointment, aristol ointment, boric acid ointment, or a 3 per cent milk of sulphur ointment, to which resorcinol may be added. The latter application is useful in the squamous variety alone. Blepharitis due to the presence of the Morax-Axenfeld bacillus should be treated by application of a 1 per cent solution of sulphate of zinc. In the ulcerated form, if the crusts are tenacious, these, as well as the stunted cilia, must be removed with forceps, and yellow oxide of mercury ointment, or some similar application, applied. Excellent results follow touching the crater-like abscesses in the edges of the lid with a 1 per cent solution of nitrate of silver. If there is an accompanying conjunctivitis a boric-acid solution is suitable, any obstruction of the lacrimal duct—a frequent accompaniment of the disease—must be removed and the nasal passages explored for any chronic inflammatory condition. The relation between this disease and refractive errors demands the correction of the latter before hope for cure may be entertained. Chronic blepharitis, always an intractable affection, should be studied and treated from the bacteriological and dermatological standpoint. The lid affection may be an eczema, a seborrhea, a sycosis, or a form of acne. The character of the bacterial strain obtained from cultures from deep pockets of infection determines the kind of local application required; autogenous vaccines are of service; the administration of foreign proteins may be required; radiation (roentgen-ray therapy) *expertly* applied is of advantage.

BLOOD–PRESSURE.

It is not possible to discuss in this space the physiology and pathology of abnormally high blood-pressure, but it is important to bear in mind that in instances in which it is abnormally high, over a considerable period of time, there is nearly always renal disease existing as a cause or as a closely associated state. It is also important to recall that whereas the average systolic pressure in males in early middle life may be placed at 135 to 140 and the diastolic from 80 to 90, that there are individuals who may be said to be normal with systolic pressure 10 or 15 points lower than these figures; particularly is this true of women. So, too, the systolic pressure may be 10 to 15 points higher, in healthy males, than the figures given, but in all persons young or old, the diastolic pressure is the important factor to be studied since a diastolic pressure constantly above 100 indicates as a rule, that conditions are not entirely normal although a diastolic pressure of 100 in persons over forty years is often met with in healthy persons. So, too, very low diastolic pressures may be present in healthy persons.

The blood-pressure estimation, without studying the entire organism of the patient, is of relative little value. It is not to be forgotten that a pressure above what is considered normal is often compensatory in the sense that it is needed to supply the tissues with blood through narrow and roughened bloodvessels, and it not infrequently happens that the physician in combating high pressure actually harms the patient by interfering too actively with this type of circulatory compensation. High pressures are to be lowered, when it is possible so to do, only when they result in undue strain upon the heart and bloodvessels and are in excess of the needs just referred to.

The nitrites, such as sodium nitrite, are capable of lowering pressure in direct proportion to the degree that the tension is due to vascular spasm and they fail in direct proportion to the degree of fibrosis. Cardiac sedatives to diminish the force with which the heart delivers blood to the arterial tree are almost always useless and indeed contraindicated. So, too, the resort to a salt-free diet is usually unwise unless it can be shown that there is undue retention of the chlorides. Salt is a food and if the patient is starved of it his pressure will fall as it will fall if he suffers other forms of starvation, but he is not better for it.

It has been shown that meat is not only not harmful and if used so that the patient receives about 70 grams of protein a day, if he weighs 150 pounds, is necessary for his nutritional balance. It should not be taken to excess.

Without doubt the various iodides taken, in moderation, so as not to disturb the stomach, over long periods, tend to arrest the processes which result in high pressure, and electric cabinet baths and other hydrotherapeutic measures are often advantageous unless myocardial degeneration is marked.

A method of living whereby physical, and particularly mental and nervous stress is avoided is essential and it is to be recalled that by this means we protect the heart which is called upon for undue labor at a time when its own coronary vessels are not as capable as in earlier life to supply its muscle with blood. Rest for such hearts and bloodvessels is far more important than the use of cardiac stimulants which may actually force the heart to increased effort when its energy should be conserved as much as possible.

To attempt to treat a patient with an abnormally high pressure directing attention solely to this condition without studying all the factors present in his or her case is not only futile but bad practice.

Not only in the course of acute disease, but also in those who may be said to have a constitutionally low pressure we must recognize that we have at present practically no drug that will raise such a pressure except for a very brief period, that is, long enough to be of real service. Pituitrin (see Pitressin under Pituitary Gland), adrenalin and ephedrin belong to this class (which see Part II.). In acute illness, caffeine, strychnine and digitalis often do good rather by preventing a further fall in pressure than by actually raising it and often the relief of toxemia, if that is possible, indirectly raises pressure. In high pressure cases during acute illness it is usually best not to interfere lest a sudden undesirable fall take place, but in chronic high tension, as already intimated, dietetics and other non-medicinal measures are better than drugs as a rule.

BOILS.

Boils are dependent upon an infection of the sweat glands, or, more rarely, on some local irritation of the skin permitting infection, as in the persons of oil- or paraffin-workers.

When boils are persistent and recurrent some cause which decreases vital resistance should be sought for, as, for example, diabetes.

The constitutional treatment rests upon the use of fresh air, cod-liver oil, iron, arsenic, phosphate of sodium, and, if any boils are present, the use of sulphurated calcium in the dose of $\frac{1}{10}$ grain (0.006) every five hours. The sulphurate of calcium hastens the maturation of boils and prevents the formation of new ones, but is useless, according to its original user, Dr. Ringer, in the boils which appear during the course of some cases of diabetes.

The local treatment of boils may be divided into the abortive and curative methods. The abortive method consists in painting *around* the inflamed spot, when the trouble first begins, with solution of gun-cotton (collodion), and renewing the coat hour after hour until a heavy contractile covering is formed. The center of the swelling must not be covered by collodion, for if pus forms under this it may do harm; and if this does occur, then the boil must be opened under antiseptic precautions and properly dressed. A strong solution of nitrate of silver is also very useful at the beginning of the formation of a boil if painted over the part in the strength of 20 grains (1.3) to (1.3) to the ounce (30.0). The other local applications consist in the use of the extract of opium or belladonna over the part to relieve pain and decrease the inflammation. Poultices may also be used to relieve the sensation of tenseness and mature the boil, or a 30 per cent ointment of ichthyol in lanolin applied.

Ringer recommends the application of alcohol and camphor over the skin in the early stages. After the skin is wiped dry it is to be smeared with camphorated oil. Stelwagon used the following:

℞—Ichthyolis	ʒj (4.0)
Emplastri plumbi	ʒij (8.0)
Emplastri resinæ (U. S. P. 1890)	ʒij (8.0).—M.

S.—Apply to the part.

He also approves of the injection of a few minims of a 5 per cent. solution of phenol into the apex of the boil if its formation is assured.

A very useful plan after the boil has formed is to wrap a little absorbent cotton around a sharp stick, dip it in phenol and bore it into the center of the boil, taking care not to bore beyond the base of the pus cavity. The parts are then washed with peroxide of hydrogen and dressed with a 10 per cent ointment of salicylic acid. If there is a large slough that does not come away, the part may be dressed with a 1 per cent solution of sodium citrate placed on lint or gauze.

When boils occur in the external ear, the canal should be frequently irrigated with hot water, and if the boil is mature it is to be incised. A useful pain-relieving dressing for the boil is as follows:

℞—Iodoformi	gr. iv (0.25)
Mentholis	gr. ij (0.12)
Petrolati	ʒj (4.0).—M.

S.—Smear on cotton plugs and insert in the ear twice or thrice a day.

The use of staphylococcic vaccine is not to be forgotten. (See Vaccine-therapy, Part III and Carbuncle, Part IV.)

BREAST (INFLAMED).

(SEE PUERPERAL DISEASES).

BRONCHITIS (ACUTE AND CHRONIC).

Many members of the medical profession regard the bronchial tubes as pipes which convey air to the vesicular portion of the lung, and do not bear in mind that as a matter of fact they have other functions which are of importance and closely related to the vital function of respiration.

In the first place it is to be recalled that the bronchial mucosa is occupied with cilia which continually pass, from the distal to the proximal portions of the respiratory tract, dust and microörganisms which are taken in with the inspired air, and again it is not to be forgotten that in cases of disease these cilia are not only inactive but are often destroyed, and, therefore, the lungs suffer from the absence of their protective function. Indeed in many instances respiratory difficulties are not removed until the cilia are regrown.

Moore has contributed an interesting paper from the Jefferson Medical College Hospital dealing with this subject, and by reason of careful bronchoscopic examinations the above statements may be considered as beyond criticism.

In still another valuable paper, Macklin by means of careful roentgen-ray investigations has found that the elasticity of the normal bronchial tubes is a most important factor in preserving health and that they lengthen and shorten with each inspiration and expiration. By the exercise of these elastic movements they not only aid in the distribution of air in the lungs but also influence adjacent tissues, changing the position of the heart considerably, to the extent of the width of a rib and an intercostal space; also moving the great vessels and the contents of the mediastinum and influencing the contents of the pleural spaces as well.

Again, Macklin found that while most books on anatomy state that the lower end of the trachea is fixed, this is entirely untrue, since on inspiration tracheal descent involves stretching of the tube, and on expiration there is a corresponding recoil of its elastic tissue. Freedom of movement of the roots of the lungs is also found to be essential to the free expansion of the apices of the lungs, particularly posteriorly, since fixation of the lung roots will not allow full expansion of the lungs following the descent of the diaphragm.

The fact that the bronchial tubes lengthen and shorten with each complete respiratory act necessarily influences the vesicular portion of the lungs, since as the tubes lengthen the space between them has to be increased, and by this means a better lung inflation results. In other words, as Macklin well says, the lung is not a simple elastic sac as some works on physiology picture it, but its inflation and deflation are largely governed by the elastic nature of the bronchial tree.

These two papers are not only of great practical importance, but that of Macklin certainly indicates that in studying disorders of the bronchial tubes the roentgen-ray is to be used not alone to discover bronchiectasis or peribronchial thickening, but for the purpose of discovering whether the elastic movements of the bronchial tubes are impaired.

An interesting illustration (Fig. 116) of the lengthening and shortening of the bronchial tree on expiration and inspiration taken from Macklin's paper is appended. The dark lines show how much shorter the bronchial tree is in expiration than on inspiration.

In the early stages of bronchitis there is always present a very distinct hyperemia, followed by a true inflammation of the mucous membrane lining the bronchial tubes. When these changes are confined to the larger bronchi the term "bronchitis" is employed, but when the minute bronchioles are invaded the disease is known as "capillary bronchitis." In many cases the physician only sees the patient when the second stage of the disease is present, but if the individual presents himself promptly, the following history and physical signs will indicate the treatment to be employed: After exposure, more or less severe, to wet, dampness, or dry cold, a sensation of oppression comes on, associated with a feeling of "tightness across the chest" or a sensation as if a bolus of food was under the sternum. Aching and pain may be traced over the lines of the bronchial tubes, while the dry, hacking cough increases the discomfort and seems to strain the tubes until each one can be outlined on the chest-wall by the patient. The cough, when it occurs, is virtually unproductive, and often causes pain in the larynx and throat. On making examination by auscultation there will be found over the posterior aspect of the chest, between the shoulder-blades, sounds of bronchial breathing, which are rougher than normal, and due to the air passing over an inflamed, swollen, and roughened mucous membrane. This bronchial roughening may be sufficient to cause a harsh inspiratory sound over the entire chest, and the expiratory sounds may be heard a little louder than usual. No other changes from the normal can be noted, but isolated spots of discomfort may be pointed out by the patient, where aches, "catches," or "kinks" seem to be present in a previously normal tube. Percussion, palpation, and inspection show nothing more of note. Some fever may be present.

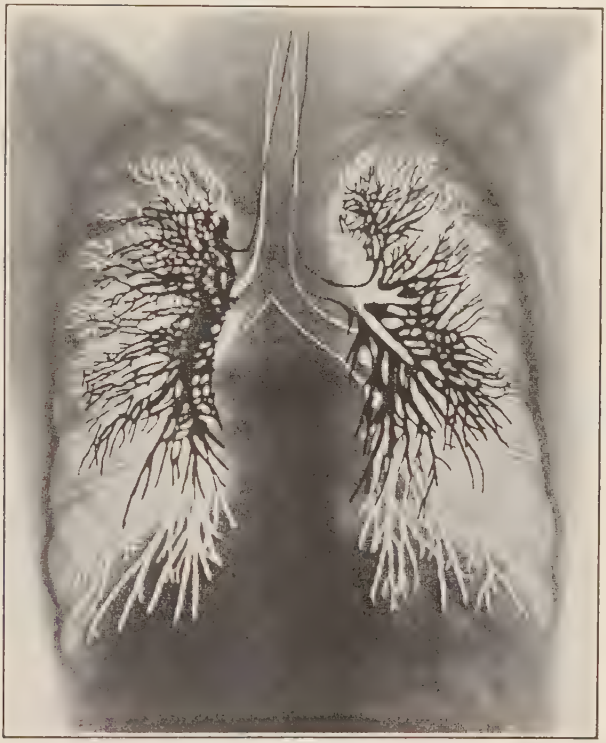

Fig. 116.—Showing lengthening of bronchial tubes on inhalation and shortening on expiration. (Macklin, *Amercian Journal of Anatomy.*)

The patient should receive a hot foot-bath, take a glass of hot lemonade with a little whisky in it, and go to bed at once, in order that, by inducing a profuse perspiration, he may relieve the bronchial congestion. Often a dose of Dover's powder is useful in hearty adults to aid in causing perspiration. In children the chest should be well rubbed with camphor liniment and a little tincture of aconite be given in water with sweet spirit of nitre every hour, as follows:

℞—Tincturæ aconiti		♏xxiv (1.5
Spiritus ætheris nitrosi		f ʒij (8.0)
Aquæ destillatæ	q. s. ad	f ℥j (30.0).—M.

S.—A half-teaspoonful (2.0) to a child or a dessertspoonful (8.0) to an adult in) water every hour.

In many adults 5 to 10 grains (0.3–0.6) of Dover's powder, with a hot drink, are better.

If the attack is not aborted while the first stage is still present, before secretion is established, resort should be had to ipecac and to citrate or acetate of potassium, which act as sedatives to the inflamed mucous membranes and aid in the formation of secretion, moistening the inflamed surfaces and thereby overcoming the dryness and irritation. These potassium salts also act as febrifuges, and should be used in full doses, as much as 40 grains to 1 dram (2.6–4.0) a day, in addition to the aconite already recommended. The following prescriptions illustrate their employment:

℞—Syrupi ipecacuanhæ		f ʒj vel f ʒiij (4.0–12.0)
Potassii citratis		ʒiv (16.0)
Aquæ destillatæ	q. s. ad	f ℥vj (180.0).—M.

S.—Dessertspoonful (8.0) every four hours for a child of five years.

Or,

℞—Syrupi ipecacuanhæ		f ℥j (30.0)
Succi limonis		f ℥j (30.0)
Potassii bicarbonatis		ʒiv (16.0)
Spiritus ætheris nitrosi		f ℥j (30.0)
Aquæ destillatæ	q. s. ad	f ℥vj (180.0).—M.

S.—Dessertspoonful (8.0) every four hours for an adult. This mixture should not be corked for some time after it is made.

For a child this prescription should be reduced just one-half in each part, with the exception of the water.

In some cases, particularly if the patient be a child, large doses of the citrate, or other salt, of potassium exert a depressing influence and have to be decreased.

Counterirritation may be applied to the chest in the shape of a mustard- or spice-plaster. If the soreness of the bronchial tubes is not relieved by this means, inhalations of steam arising from boiling water may be practised, either through a cone, one end of which covers the top of a pitcher and the other end of which covers the mouth and nose of the patient, or by covering the head and pitcher with a towel. The usefulness of this method may be much increased by the addition of 1 tablespoonful of compound tincture of benzoin to each pint of water.

In young children, particularly in the first stage of bronchitis and in the later stages, the use of the so-called "bronchitis-tent" is of great value. It consists of a canopy raised over the bed a sufficient distance to allow of the circulation of plenty of air. Through one side of this canopy passes a tube leading from an Arnold Steam Sterilizer which is manufactured to prepare milk for infants, under which is an alcohol lamp to keep the temperature of the water sufficiently high (Figs. 117 and 118). By this means the air breathed by the patient is so

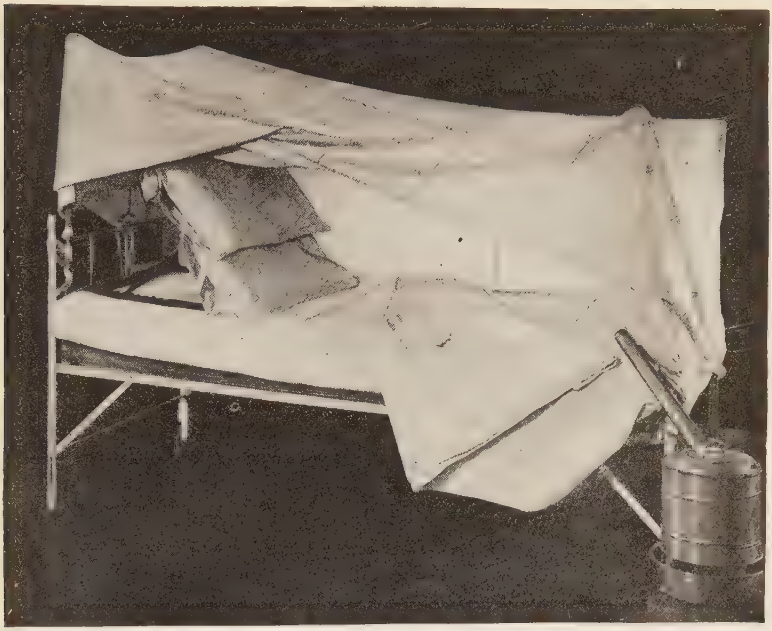

Fig. 117.—Bronchitis-tent put up by aid of two sheets pinned together and four broomsticks lashed to corners of bed. The steam arises from an Arnold Steam Sterilizer to which has been attached a tube. When in operation the side flap of the tent is dropped.

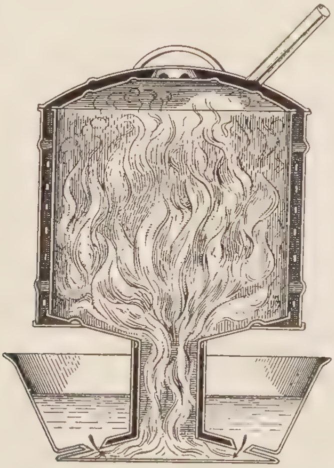

Fig. 118.—Arnold Steam Sterilizer, showing self-feeding reservoir and small volume of water to be heated.

saturated with moisture that the mucous membrane lining the air-passages is soothed and quieted. In order that the full benefit of this measure be understood, it must be remembered that a mucous membrane in the early stages of inflammation is always dry and red, lacking its normal moisture, and that the upper air passages fail to catch upon their surfaces, by reason of their dryness, particles of dust, and do not moisten the air before it reaches the lungs. Again, it will be remembered that the bronchial mucous membrane is covered with ciliated epithelium, which, by the constant, upward, wavy motion of its cilia, urges out of the tubes all impurities. Dryness of the surface at once stops these ciliated movements, with unfavorable results. The employment of the "bronchitis tent" is equally useful in adults unless there is profuse bronchial secretion.

Having considered the treatment of the first stage of bronchitis, we pass to that of the second. The condition of the mucous membranes is now quite different from that which has just been spoken of. In the place of an absolute lack of secretion a profusion of cast-off epithelial cells, a large amount of mucus, and more or less liquid have been poured out upon the walls of the bronchial tubes, forming obstructions everywhere to the ready passage of air. The secretion is apt to be more or less viscid and ropy, and, when it is coughed up after considerable effort, appears in lumps, particularly in the morning. This state is one in which the excitement of inflammation is followed by local depression and an effort on the part of the tissues to rid themselves of the congestion and of the excess of mucus and epithelial cells. The physical signs on listening to the chest are now found to consist in a large number of loose râles, which are distinctly wet and moist. Later they become markedly liquid and bubbling, and so cause gurgling on inspiration and expiration. Sometimes they are musical or squeaking. Generally the latter signs do not come on until the case is far advanced, and, if a cure is soon to be reached, they last only a few days or hours, as the mucus is so loose as to be easily coughed up and the tubes readily cleared.

The object of the physician is to use remedies which will stimulate the bronchial tubes and increase the volume of liquid poured out. For this purpose the bronchitis-tent may of course be employed, but the drugs to be used internally are the chloride of ammonium and the pitches and turpentines, such as terebene, or terpine hydrate.

In the majority of instances an ammonium mixture will be the best and most serviceable prescription, in one of the following forms:

℞—Ammonii chloridi	ʒij (8.0)
Fluidextracti glycyrrhizæ	fʒij (8.0)
Aquæ destillatæ . . . . q. s. ad	f℥iij (90.0).—M.

S.—Teaspoonful (4.0) to dessertspoonful (8.0) every four hours.

Or,

℞—Ammonii chloridi	ʒij (8.0)
Misturæ glycyrrhizæ compositæ	f℥iij (90.0).—M.

S.—The same dose.

The advantage of the latter prescription is the presence of antimony in the compound liquorice mixture, which tends to increase secretion, but is contraindicated if debility exists.

If the cough is troublesome, a little morphine or codeine may be added, or the following be used particularly if the circulation is feeble.

℞—Ammonii chloridi	ʒj (4.0)
Ammonii carbonatis	ʒj (4.0)
Ammonii bromidi	ʒj (4.0)
Fluidextracti glycyrrhizæ	f℥iv (16.0)
Aquæ destillatæ	f℥vj (180.0).—M.

S.—Dessertspoonful (8.0) every four hours.

In this prescription the first constituent acts particularly on the air-passages, the second stimulates the heart and respiration, and the third allays the cough, while the liquorice masks the salty taste of the ammonium. Still another recipe is:

℞—Codeinæ sulphatis	gr. ij vel iv (0.12(0.25)
Ammonii chloridi	ʒj (4.0)
Fluidextracti glycyrrhizæ	f℥j (30.0)
Aquæ destillatæ	q. s. ad f℥ij (60.0).—M.

S.—Teaspoonful (4.0) every two hours in water.

An oro-nasal respirator, with the sponge saturated with equal parts of terebene, iodide of ethyl, and chloroform, may be worn in order to allay cough and loosen the mucus. Sometimes the use of a nebulizer, as shown on page 635, is very useful, or Yeo's inhaler may be used. (See Creosote, Part II., and Inhalations, Part III.)

If the administration of the chloride of ammonium does not aid in the expulsion and liquefaction of the secretion and rid the lungs rapidly of the mucus, the use of terebene in 5- or 10-minim (0.3–0.6) capsules may be resorted to with success. If capsules cannot be supplied, terebene may be made into an emulsion with acacia or tragacanth and given in this way. Sometimes terebene will irritate the kidneys and produce a sense of weight across the loins; if this occurs, its use should be stopped. In other cases it will disorder the stomach, or cause diarrhea. These effects are not, however, commonly seen. Terpine hydrate in 10-grain (0.6) doses may be used three times a day usually in the form of the elixir, or terpinol in the dose of 8 to 10 grains (0.5–0.6) in a capsules or pills.

An excellent combination is the elixir of terpine hydrate with codeine, which may be given in the dose of 1 dessertspoonful (8.0) every four hours in a little water. Certain of the volatile oils and resins are also of value at this time, notably the oleoresin of cubebs and copaiba, which, however, possess the disadvantage of disordering the stomach. The oil of eucalyptus is also of great value, and may be given in capsule or emulsion in the dose of from 1 to 5 minims (0.06–0.3) every five hours. The oil of sandalwood in the dose of 5 to 10 minims (0.30–0.6) is very valuable, and is not so apt to disorder the stomach, bowels, and kidneys as are some of the other remedies named.

While the proper use of these remedies usually brings about the results desired, in some cases a stage of profuse secretion comes on which in its treatment is identical with that seen in chronic bronchitis, and chronic "winter cough" with emphysema, so these diseases will therefore be considered together.

In old persons suffering from dilated bronchial tubes, from emphysema, and from chronic bronchitis there is constantly poured into the air-passages so free a secretion that persistent coughing is necessary to rid the lung of enough of the mucus and liquid to enable them to breathe. Any excess of this exudation drowns him in his own secretions, and the constant obstruction to the ready flow of air and blood in the lung soon produces dilatation and weakness of the right side of the heart.

The same condition in a more acute form sometimes asserts itself in young children and in adults. In children it sometimes comes on so suddenly as to be known as "acute suffocative catarrh," while in older persons it appears with sufficient severity to make the condition of the patient most serious. Of the treatment of the latter state the writer will speak at once.

The objects desired are to rid the lung of the liquid secretions, to prevent the outpouring of more exudate, and to support the patient until the crisis is past. Digitalis should be administered to support the heart, and strychnine be employed in full dose to stimulate the respiratory center and excite the nervous system, which is generally depressed by the increasing carbonic acid in the blood. For the same purposes caffeine or strong coffee may be used. Oxygen may be inhaled (see Part II), and to check the profuse secretion atropine should be used by the mouth or hypodermically. When cyanosis is marked and the patient is a child and stuporous, it may be alternately dipped in a tub of hot and cold water to cause reaction and stimulate the dormant nerve centers to greater activity, and so by reviving, respiration is maintained until voluntary efforts to rid the bronchial tubes of secretion are made by the patient. Sometimes letting the patient hang his head over the side of the bed when he coughs may aid in the expulsion of the liquid. (See Carbon Dioxide, Part II.)

The treatment of the more moderate condition of excessive secretion in the bronchitis of old persons, which is more slow in its progress, but which may end as fatally as like attacks in the young, is somewhat similar to that just given. Injurious results are often produced by the physician failing to recognize that the secretion is sufficiently fluid, and that ammonium chloride and such expectorants are not only useless, but distinctly harmful because they increase the quantity of these liquids. Under these circumstances the application of several dry cups over the bases of the lungs posteriorly often gives a great deal of relief; or if cups cannot be obtained, then active counterirritation by means of a mustard-plaster or turpentine stupe is advisable. The cups are, however, the remedy of choice. Atropine, which checks secretion, stimulates the respiratory center, and is for this reason a useful remedy. Strychnine or caffeine are, however, the best of remedies to help the patient get rid of the sputum. The strychnine should be given in the dose of $\frac{1}{20}$ grain (0.006), or more to an adult, three times a day. When the condition is pressing atropine and strychnine should be used hypodermically.

The use of remedies designed to allay the cough in these cases is absolutely unjustifiable, as it results in retention of the profuse secretion. The question as to whether the cough is excessive or not must depend on the ability of the patient to rid himself of the secretions in the bronchial tubes.

BURNS AND SCALDS.

The treatment of burns and scalds is both internal and external, the first being devoted to the relief of pain, and the treatment of shock; and the second to the care of the injured surfaces. Immediately upon being called to a severe case of burn it is the duty of the physician to determine how badly shocked the patient is, what the condition of the pulse may be, and whether or not the lungs and air-passages are involved. After these mental notes he should give a hypodermic injection of $\frac{1}{4}$ to $\frac{1}{2}$ grain (0.015–0.03) of morphine and $\frac{1}{100}$ of atropine (0.0006), and then roll the entire body in a large blanket to maintain the body heat, while the sufferer is being transferred to the hospital or the house to which he belongs.

In severe cases the shock is so great that the pulse flags at once, the temperature falls, and collapse ensues. External heat, and drinks of hot water and whisky are indicated, followed by $\frac{1}{20}$ grain (0.003) of strychnine if the circulation does not respond to the less powerful stimulants. Adrenalin chloride, 1 dram (4.0) of a 1 to 1000 solution may be given very slowly intravenously in 1 pint of normal saline solution in severe cases, and normal saline by hypodermoclysis to the amount of $\frac{1}{2}$ to 1 pint (500). The normal saline is needed as it has been shown that great concentration of the blood occurs and if possible as much as 1 or 2 quarts should be given by the mouth in twenty-four hours. This is the more important because there is prone to be a great loss of chlorides when the burn is severe. A very useful treatment under these circumstances is to immerse the patient in a bath of normal saline warm enough to maintain the body temperature. Often while in this bath the burned cuticle is easily removed with but little pain, and the protection from the air decreases dermal irritation. The patient should be allowed to remain as long as shock lasts, in a bed covered like a small tent and kept above body heat by carbon incandescent lamps. This treatment of shock is far more important than the care of the burns. The removal of clothing and the application of dressings must wait until the patient has rallied well. (See article on Shock.) When the toxemia is severe, particularly in a child, transfusion of blood may save life.

Recently tannic acid has been largely used in the treatment of severe burns with the idea that by coagulating the albumen in the part it will prevent toxic absorption. After blisters are opened the part is kept wet with a solution of 10 per cent sprayed on with an atomizer every two hours. After twenty-four hours the dressing is removed and it will be found that the area is a light brown color. It is then left exposed to the air, and sprayed again, but protected from injury or infection by a cradle made up of sterile gauze or linen, the air in the cradle being kept warm by means of electric bulbs. If no tannic acid is at hand a very strong infusion of tea may be employed. If serum collects under the brown coating, the coating is removed by debridément and again sprayed. Absorption from the blister must not occur. If the burn is deep enough to involve subcutaneous fat, suppuration is prone to occur, as evidenced by a rise in temperature. The brown tannic acid scab should be removed and the method described below instituted. (See also Hexylresorcinol S. T. 37, Part II.)

In other instances if the area is clean the surface may be sealed by a paraffin dressing. The surface should be dried if moist by an electric fan or barber's dryer and then the paraffin should be sprayed or painted over the surface and covered by layers of paraffined fly-netting, over which is laid a thin layer of coarse muslin netting, the threads of which should be preferably already impregnated with paraffin, and over this in turn is painted more melted paraffin. A useful spray can be obtained by the common tin "bug gun." The solid paraffin should melt at 50° C. (122° F.), should be pliable at 28° C. (82.4° F.), and several layers of dressing extending over the adjacent healthy skin should be applied. This plan is clean, efficient and cheap. The dressing should be changed in twenty-four hours, and the wound cleaned not by the aid of liquids, but by patting it with dry gauze. (See Antiseptics, Part III.)

When the surface is probably infected, the blisters and dead skin should be gently removed and the above plan carried out unless streptococci are present. If positive infection is present of any kind, paraffin should not be freely employed, as it prevents drainage. The part should be cleansed with a very weak solution of dichloramine-T, not stronger than $\frac{1}{20}$ per cent, care being taken to be sure it is alkaline by adding sodium bicarbonate. The surface is then treated by a single layer of paraffin netting to permit drainage, and once in twenty-four hours the area is washed with sterile salt solution, dried by heat from a carbon light, or sunlight, again applying the germicide and the paraffin gauze keeping the patient in the warm tent uncovered otherwise.

The method of sealing the surface with a heavy dressing has been discarded, because it results in toxic absorption. This is very important because it has been shown that the late collapse twenty-four or more hours after a burn is due to toxic material absorbed after autolysis takes place. When the burn is so severe that the tissues are charred this autolysis is less prone to occur.

Fairly wide-mesh muslin fly-screen, dipped in the melted paraffin after the muslin has been sterilized by moist heat, not washed, is a simple and useful material, as it permits drainage which gauze does not.

Monteith and Clock have obtained excellent results by soaking the burned area for an hour in warm normal saline, removing dead tissue so loosened, and spraying the area with normal horse serum which is marketed in tubes containing cresol as a preservative. The surface is then covered by rubber tissue to prevent drying. The spraying is repeated from twice to four times a day in order that the surface may be kept moist. They assert that cicatrization is reduced to a minimum and healing is rapid.

CARBUNCLE.

The best treatment consists in making a horizontal and then a lateral incision deep and long enough to reach healthy tissue, first shaving and washing the part with ether. Raise each flap and dissect out all dead tissue with sharp scissors. Control bleeding by compresses of gauze dipped in hot saline solution and wrung dry. If bleeding is excessive, control it by electrocautery or an ordinary hot soldering iron. Next pack area involved with gauze soaked in saturated solution of magnesium sulphate. Apply dry gauze, cover with cotton wool and put patient to bed to sleep off anesthetic. After twenty-four hours renew the dressing and then change it every twelve hours. Usually these dressings at first require the use of nitrous oxide. The gauze should be softened by normal saline or hydrogen peroxide, and withdrawn gently taking care after the area is repacked that the edges of the wound are not allowed to touch. The skin over the surrounding parts must be washed each time with ether to prevent infection developing in nearby follicles. If the edges of the wound undergo necrosis they should be excised. Absolute rest of the part is essential.

Pure carbolic acid when used to swab the cavity surfaces after they have been dried by dry swabs, is less painful but convalescence is delayed. Care must be taken that the phenol does not touch the edges of the skin.

A non-operative plan is that of Morrison. Mix 1½ pounds of *dried* magnesium sulphate with 11 ounces of glycerinum acidi carbolici and pure glycerin equal parts. The commercial salt should not be used as it does not produce so free a flow of serum. A paste is formed by mixing the salt and glycerin in a hot mortar using a hot pestle. Place in a covered jar to prevent absorption of moisture from the air. Apply the paste, after cleaning the skin with ether, on lint, to whole area involved. Cover with thick pad of absorbent cotton and dress every twenty-four hours at least. This plan relieves pain and the slough may come away in less than seventy-two hours. After the slough comes away pack the cavity with gauze saturated with magnesium sulphate as already directed above. This treatment may well be used when a general anesthetic is contraindicated.

CHANCROID.

The chancroid is a contagious ulcer which has no definite period of incubation, is acutely inflammatory in type and is often multiple. It is further distinguished from the primary sore of syphilis by the fact that it is auto-inoculable, is not followed by secondary eruptions, and, if it involves the lymphatics at all, produces an acute inflammatory swelling, which frequently attains a considerable size and suppurates. A specific bacillus can be recovered from its discharge.

Many of the chancroids as found in persons of robust health show little tendency to spread. It must be remembered, however, that as long as the smallest portion of such an ulcer remains unhealed it may at any time take on all the features of a virulent ulceration. Moreover, the patient is constantly exposed to the risks of a chancroidal bubo—a complication so troublesome that the possibility of its development constitutes the strongest argument against palliative in distinction from radical treatment.

Chancroid may be aborted by a prompt and thorough washing of the surface exposed to infection, followed by an application of 33 per cent calomel ointment, which should maintain contact for one or two hours.

The treatment of uncomplicated chancroid in its early stage is as simple as it is efficient. One thorough cauterization converts the sore into a healthy ulcer, the cicatrization of which is quickly and surely accomplished.

As the most efficient means of thoroughly destroying chancroidal ulcerations the actual cautery is chiefly commended. Nitric acid will be found equally serviceable; it may be applied by means of a glass rod or a cotton applicator. The pain of these applications may be greatly lessened by a ten-minute application of a pledget of cotton soaked in a 5 per cent solution of cocaine. It may be completely abolished by block or by general anesthesia. The cardinal point in the cauterization of chancroids is to *reach and destroy all the diseased area.* Cauterization is preceded and followed by a thorough cleaning of the region involved. For one or two days after cauterization the parts should be dressed with gauze kept wet with a mixture of dilute lead-water and alcohol, equal parts. Thereafter dry dusting-powder may be used.

There may be substituted for this treatment one less radical, more acceptable to the patient, and in many cases almost equally satisfactory in results.

Where the ulceration is entirely superficial, constituting the erosive form of chancroid, iodoform, dusted over the surface of the carefully cleansed granulations, offers the best form of palliative treatment. The dusting-powder should be preceded by careful spraying with peroxide of hydrogen 1 to 4, followed by a spray of mercury bichloride 1 to 4000. The objection to iodoform lies in its odor. To overcome this, the powder should be dusted only upon the sore. The odor can be disguised to some extent by thoroughly mixing with the iodoform a small quantity of one of the essential oils, such as oil of peppermint or attar of roses, using not more than 5 minims (0.3) to 1 dram (4.0) of the powder. There is no dusting-powder which can entirely take the place of iodoform, yet, when the objections to the use of the latter are insuperable, thymol iodide or iodol may be substituted, or a mixture of 1 dram (4.0) of zinc oxide and 3 drams (12.0) of subnitrate of bismuth, or equal parts of calomel and bismuth. If the dusting-powder be allowed to form a crust beneath which the discharge collects under some tension, the development of bubo will be distinctly favored. It is, therefore, needful when dusting-powders are used that the dressing should be repeated several times a day, the lesion being first cleansed with hydrogen peroxide, 1 to 4, then dried by means of absorbent cotton, and finally dusted with the powder of choice. Gauze dressing is then secured in place by bandages, straps, or, when this is applicable, by pulling the foreskin forward.

Wet applications frequently changed, because of the greater cleanliness and better drainage which they insure, are less likely to be followed by complications than are dusting-powders. In the small not markedly inflammatory or rapidly progressing lesions it suffices to supply the patient with a bottle of antiseptic solution—dilute lead-water answers well—and an adequate quantity of cotton or gauze. At each act of urination he changes his dressing, retaining it in place in the simplest practicable way, spraying the lesion night and morning with dilute peroxide solution. When, however, the sore is attacked by a high grade of inflammation, prolonged immersion of the part involved or of the whole body in hot water is indicated, followed by the application of dressings kept constantly wet with dilute lead-water and alcohol.

Where the chancroid assumes the phagedenic type, extending with great rapidity and causing extensive sloughing and destruction of tissue, free cauterization, either with the hot iron or by means of nitric acid, should be instituted immediately, every portion of the ulcerating surface being thoroughly destroyed. This should be followed by prolonged hot sitz-baths or general warm baths, of from two to four hours' duration twice daily. In addition, the patient may be given full doses of opium, and should receive a tonic and supporting treatment. (See Antimony, Part II and next page.)

There is a gangrenous balanitis, sometimes called the fourth venereal disease, due to a symbiotic infection (vibrio and spirochete) following sexual or perverted sexual contact, usually diagnosed as chancroid, beginning with one or more ulcers and attended by marked edema and the constitutional symptoms of an acute infection. The diagnosis is made by the microscope. Cleansing treatment is efficient. To expose the lesions and insure adequate drainage splitting of the foreskin may be needful. The ulcerating surface is sprayed or bathed with hydrogen peroxide, 1 to 4, every two hours, and is dressed with gauze or cotton kept wet with potassium permanganate, 1 to 4000.

Inguinal granuloma simulating chancroid in the early stages, due to a specific infection (Donovan's bodies) is characterized by its chronicity and concurrent cicatrization and extension. It lasts for years, is refractory to all local treatment, affects chiefly negroes and is cured by intravenous injection of tartar emetic 3 cc. of 1 per cent solution, given every other day, the dose being increased by 1 cc. each time until pain in the shoulder indicates that the limit of tolerance has been reached. For six weeks, after complete healing of these sometimes huge and deforming and crippling scarred lesions, this treatment should be continued somewhat less intensively. (See Antimony, Part II.)

The chancroidal bubo is best avoided by prompt and thorough cauterization of the sore, or by frequent thorough cleansing and the avoidance of retained discharge; when it occurs, however, it should be first treated by rest in bed and the application of a hot-water bag, since it may be a simple inflammatory adenitis and, with care, may not go on to suppuration. At the first sign of suppuration the bubo should be punctured by a tenotome, evacuated, washed out with Dakin's solution and dressed antiseptically. If there be a reaccumulation of pus the puncture and washing should be repeated. If inflammatory symptoms still persist the diseased gland should be thoroughly removed by dissection or the curette through a free opening, the resulting wound being drained by rubber tissue and sutured.

CHLOROSIS.

(See Anemia.)

CHOLERA, ASIATIC.

The treatment of this exceedingly dangerous disease is prophylactic, curative, and convalescent.

The first measure consists of strict quarantine, both public and private, the avoidance of all water for culinary purposes which has not been boiled at least one hour and cooled in a place devoid of germs, the use of no food which may be contaminated, and the employment of those foods which, while preserving the normal bodily health, in no way predispose to intestinal disturbances, as do some of the fruits, as melons and grapes. If these precautions are observed, little remains to be done. After onset, before and after the stage of purging is reached, morphine and atropine should be freely used as they also tend to check vomiting. (The Vaccine Treatment Part III.)

Accumulating evidence is to the effect that the internal use of kaolin (Chinese clay) is the best form of internal medication. Kaolin is insoluble in water and has to be given in the form of a bolus or by getting the patient to partake freely of a half and half mixture of kaolin and water, there being no limit to the dose as kaolin is not absorbed. Even if it is vomited the attempt to take it should be persisted in, all food being withheld for twenty-four hours. Walker states that it should also be given by rectal injection as soon as the bowel will tolerate it. The treatment is said to cause marked improvement in twelve to twenty-four hours and the change for the better is shown by the arrest of vomiting, a decrease in the stools in a rapid diminution of toxemia, and a return of renal secretion and consciousness in those far enough advanced to have these symptoms. As kaolin has no bactericidal effect its action is probably due to its absorption of the toxins and its mechanically surrounding the vibrios. It also coats the entire lining of the bowel so as to arrest absorption of toxins. It has been proved that if cholera toxins are mixed with a kaolin suspension they lose their toxic properties.

Aromatic sulphuric acid is peculiarly efficacious. It is not only acid, and so deleterious to the vibrio, but, in addition, is astringent, and is probably eliminated as a sulphate by the lower bowel. As is well known, ordinary cholera morbus yields readily to its influence. It is largely used in India.

Tomb, a medical officer in Bengal, advises the following prescription when purging is active because he has found the essential oils of peculiar value.

℞—Ol. anisi
Ol. cajaputi . . . . āā f℥ij (8.0)
Ol. juniperis
Acidi sulphurici aromatici . . . . f℥j (30.0)
Spiritus aetheris . . . . f℥ij (60.0)

Sig.—30 minims in half ounce of water every fifteen minutes for two or three hours. Vomiting to be controlled by morphine given hypodermically. The total average dose is said to be 8 drams (30.0).

Camphor, seems to be universally regarded as a most useful drug, tending at once to check diarrhea and relieve the pain and cramps from the beginning to the end of the attack. Whether camphor exercises any germicidal effect on the cholera bacillus we do not know. Certain it is that volatile oils all possess distinct antiseptic powers. Aside from any such influence, camphor is useful as a general systemic stimulant, and has been proved by wide clinical observation to have a very extraordinary power in the control of all forms of serous diarrhea, particularly that of true cholera. The spirit of camphor has proved most effective in cholera epidemics. Frequently the use of camphor so controlled the diarrhea and stimulated the torpid kidneys that anuria was relieved in twenty-four hours. Under these conditions camphor wine has been found very useful; it is made by adding 75 grains of finely powdered camphor to a quart bottle of strong red wine, to which are also added gum arabic and alcohol. The camphor is first dissolved in the alcohol, and then thoroughly mixed with the wine. The dose of this mixture is a teaspoonful, in peppermint-tea, every hour to a child of six years; for an older child a dessertspoonful, and for an adult a wineglassful. Those who first used this mixture were wiser than they thought, for the studies of Pick have shown that both red and white wine are distinctly inhibitory to the growth of the micro-organism of cholera, probably because of the tannic or other acid which they contain, as well as the alcohol.

The experience of English physicians in India indicates that permanganate of potassium, given in keratin-coated pills so that it will not be decomposed in the stomach, in the dose of as much as 1 dram (4.0) in six hours, is probably even more useful than camphor.

A remedy, the use of which is based on very rational grounds, is salol, and probably acetylsalicylic acid, which, theoretically, is much better than the former, because it is less poisonous. According to the interesting studies of Löwenthal, salol seems to be peculiarly antagonistic to the bacillus of cholera. This investigator added to a 50-gram alkaline solution of pancreatic juice 10 grams of salol, and to this mixture 3 cc. of a virulent bouillon culture of the bacillus. Examinations in forty-eight hours to a week showed this to be absolutely sterile. It was further proved that the salol was inactive until broken up into its component parts—phenol and salicylic acid. Hueppe also asserts that the use of salol prevents the development of anuria.

Vomiting, purging, toxemia, cramps in the extremities, and, as the result of these, exhaustion, collapse, and the advent of the algid stage are to be combated by intra-abdominal or intravenous injection of saline solution (which see); or, if this is not possible, hypodermoclysis and the employment of a hot-water bed; or, hot bottles and bricks. It has been found that the strength of the saline solution given by the vein should be greater than usual, namely, about 1 per cent, and from 3 to 5 pints should be used whenever the blood-pressure in a European is as low as 80 mm. of Hg., or the specific gravity of his blood is more than 1063; 1056 being about normal. The flow should be at the rate of about 1 ounce (30.0) a minute. After the intravenous injection has rallied the patient the blood-pressure may be maintained by giving a rectal injection of normal saline every few hours, or hypodermoclysis may be resorted to. (See Hypodermoclysis, Part III.)

In the presence of anuria the intravenous use of sodium bicarbonate in place of ordinary normal salt solution is advantageous. The mortality with sodium bicarbonate solutions being 28.4 per cent against 42.7 per cent with normal salt solution. The strength of the solution is to be markedly hypertonic, being 20 to 30 per mille and from 500 to 1000 cc. injected.

Atropine and strychnine are useful, and ether may be given subcutaneously or by the mouth as a diffusible stimulant. If uremia threatens the use of saline by hypodermoclysis, combined with digitalis by the mouth, or caffeine, pituitrin, or adrenalin, may be resorted to to overcome renal stasis. (See article on Diarrhea.)

CHOLERA INFANTUM (INFANTILE DIARRHEA).

It is important to bear in mind that every case of cholera infantum is due to the excessive growth of microörganisms in the alimentary canal, and that in a large proportion of cases these organisms find entrance to the body through impure milk or water. For this reason the term "cholera infantum" is largely going out of use and in its place the term Infectious Diarrhea of Infancy is commonly employed. In such patients certified boiled milk is to be used as pasteurized milk is not absolutely sterile. Disturbed digestion due to extraneous causes or to excess of one of the elements of the food may be responsible. If the fats are in excess the stools are acid in reaction, may contain lumps of fatty soaps looking like curds and have a butyric acid odor. Fat curds are small or moderate in size, easily broken up and soluble in ether. Placed in water they float. When casein is in excess the odor is offensive and the stools often alkaline. Casein curds are large and tough, become hard in ether and tend to sink in water. When carbohydrates are the cause the stools are acid and smell like sour bread. If the nates become excoriated the stools are usually acid. Manifestly fats are to be cut out if the fats are undigested, protein cut down if casein is undigested and carbohydrates decreased or stopped if fermentation is present. In a certain proportion of cases microörganisms find the intestine a favorable place for growth solely because the character of the food is bad as to purity, and of such consistency or in such proportion that the digestive organs fail to deal with it properly. As a result conditions favorable to germ growth develop. To prevent this disorder careful feeding is essential, and after the child begins to convalesce careful feeding is still important. (See Feeding the Sick.) The organisms are those of fermentation in some cases, or are of the type capable of causing dysentery in others. The latter may belong to the type called the dysentery bacillus of Shiga or that of Flexner. Both of these produce greater toxemia and depression than the fermentative organisms. The gas bacillus is not uncommon and is dangerous. It produces an acid stool.

Every case of this disease is to be considered as an infectious illness, and every endeavor made to prevent the growth of malignant organisms in the bowel, to aid in the elimination of their toxins and as far as possible to support the vital forces of the patient. Hot weather predisposes a child to cholera infantum because its lowers its vitality and also tends to increase the growth of microörganisms in the milk.

Diarrhea occurring in an infant in hot weather is to be regarded by the physician as a fireman regards a fire. The only way to prevent a calamity is to regard it seriously and use every effort to prevent its further development.

Absolute avoidance of milk and the use of a few drops of beef-juice in water every hour or two for twenty-four hours are the first orders as to diet. If vomiting is active and collapse is threatened, 1 or 2 drops of good brandy should be used in each teaspoonful of food, and the value of atropine as a vasomotor stimulant is not to be forgotten.

If masses of undigested food are passed, a dose of castor oil (1 to 2 teaspoonfuls [4.0–8.0] to a child of two years), with 20 minims (1.3) of paregoric, should be used to sweep out the offending materials and allay irritation, and be followed at once by the treatment which will be spoken of later. (See Sodium Citrate.)

When the diarrhea is severe there may be much bearing down, or in other cases a simple running off of the liquid from the bowel almost without effort. Very soon, indeed, the passages become entirely colorless, except for a speck or two of green. The diapers have a peculiar mousy odor, and are characteristic, that is, they seem to be only wet and musty, and contain no solid matter. If closely examined, they will be seen to be soiled by a small amount of a whitish substance, looking like a paste made of water and fine chalk. Such a passage bodes ill for the child unless treatment is instituted. The physician should order, *at once* $\frac{1}{40}$ grain (0.0015) of podophyllin for a child of six months, to be taken in two doses, one-half hour apart, in 20 drops of brandy with a little water. Two hours after this the dose should be repeated, and again in two hours more if necessary. By the end of the fourth hour there will be generally seen in the movements of the bowels a trace of color, and this will gradually become more marked if the case is to have a favorable termination. Calomel may be used instead of podophyllin.

As soon as the movements have changed from the pasty white motions named to those having a bilious color, then, and not until then, are astringents to be employed. If they are used before this, the diarrhea may become less for a few hours, but the child absorbs poisons from its alimentary canal and rapidly goes into collapse.

The rationale of this treatment rests upon the fact that owing to the disease every gland connected with the alimentary canal has become inactive. It is absolutely necessary to bring about glandular activity and podophyllin, in the experience of the author, is the best remedy for this purpose. During the period that the podophyllin is acting it is well to apply a spice-plaster to the belly or to immerse the child for short intervals in a hot bath, if its extremities are cold, to maintain its body temperature.

In practically every case of infectious diarrhea it is of the utmost importance to stop milk-feeding absolutely for a few days. Nothing in the way of food may be given, except Valentine's Beef-Juice, 10 minims (0.6) every two hours with a little cold water, or beef-juice expressed from rare rump steak, until curds and undigested food are no longer found in the stools.

Buttermilk, more or less diluted with water and sometimes sweetened with a little sugar, is also useful when milk feeding is begun again. (See also Sodium Citrate, Part II, and Casein Milk under Foods for the Sick.)

The buttermilk with its lactic acid bacilli, or lactic acid bacilli given in tablets dissolved in water, inhibit the growth of putrefactive organisms, but are contraindicated if the stools are acid in reaction due to fermentation of carbohydrates.

When the stools are offensive and alkaline the bacillus acidophilus does good, since it stops putrefaction and permits milk feeding to be continued. As many as 10 to 40 tablets may be given crushed in the first twenty-four or forty-eight hours to produce a positive effect, but such doses are rarely necessary. No so-called intestinal antiseptics should be given for obvious reasons while the lactic acid bacillus is used.

After these measures have been resorted to, and the chief object—namely, a bilious stool—obtained, the diarrhea may be stopped gradually. The medicinal treatment should consist in the use of a mixture such as the following for a child of a year or eighteen months:

℞—Acidi sulphurici aromatici		gtt. xxx (2.0)
Tincturæ opii camphoratæ		fʒiij (12.0)
Elixiris curacoæ		fʒij (8.0)
Aquæ cinnamomi	q. s. ad	f℥iij (90.0).—M.

S.—Teaspoonful (4.0) in a little water every two hours.

Or,

℞—Acidi sulphurici aromatici		gtt. xxx (2.0)
Tincturæ opii camphoratæ		fʒj (4.0)
Fluidextracti hæmatoxylin		f℥ss (15.0)
Syrupi zingiberis	q. s. ad	f℥iij (90.0).—M.

S.—Teaspoonful (4.0) every two hours in water.

Where the vomiting is very severe and incessant, the purging profuse but free from undigested curds, a rectal injection of starch-water, 2 ounces (60.0), containing 5 drops (0.3) of tincture of opium, is to be employed, and at the same time $\frac{1}{6}$ grain (0.01) of gray powder (hydrargyrum cum creta) given every hour if the podophyllin is not well retained. The gray powder may in turn be substituted by $\frac{1}{12}$ grain (0.005) doses of calomel. Very minutes doses of arsenic given by means of the following solution are often of service in checking the vomiting and purging, and may be resorted to if necessary:

℞—Liquoris potassii arsenitis	gtt. j vel ij (0.06–0.12)
Aquæ cinnamomi	f℥j (30.0).—M.

S.—Teaspoonful (4.0) every fifteen minutes until four teaspoonfuls (16.0) are taken.

A very important, never-to-be-forgotten measure in cholera infantum is the use of counterirritation over the belly by means of a mustard-plaster (1 part of mustard flour to 8 of wheat flour) or by a spice-plaster. This plaster should be renewed as often as it cools, and kept on continuously if the skin will stand it. (See Counter-irritation for formula.)

To combat toxemia and dehydration hypodermoclysis of normal saline solution may be resorted to for collapse, or intra-abdominal injection or longitudinal sinus injection (Part III.)

A very useful measure if the child is shrunken and gray in appearance, is the transfusion of citrated blood, or better still fresh blood, as it provides fluid, sustenance, blood cells, and supports vital resistance. (See Transfusion.) About 30 to 40 cc. of blood for each 2 or 3 pounds of weight is sufficient and it may be repeated in twelve or twenty-four hours if needed.

When the patient seems stuporous and has panting respirations an examination of the urine may reveal acetone, produced as in diabetes by the utilization of fats of the body to compensate for starvation. Under these conditions dextrose may be given intravenously (see Intravenous Injections, Part III, and Diabetes, Part IV), or a 4 per cent solution of sodium bicarbonate in the dose of 75 to 150 cc. every five hours. Intravenous injections in infants are, however, very difficult therefore the intra-abdominal method may be used. This method of using dextrose is very painful unless the 4 per cent pure dextrose in sterile water is given with equal parts of Ringer's normal saline solution. (See Intra-abdominal Injection, Part III.)

Marriott has pointed out that the oliguria of these cases results in a tendency to retain in the blood undue amounts of sodium chloride and therefore the free use of this salt may increase the acidosis. He, therefore, recommends the use of sodium bicarbonate in place of saline and this can be done by seeing to it that the bicarbonate of sodium has a reaction identical with that of the blood (pH_7). This can be obtained by passing CO_2 through the solution. A drop of phenolphthalein solution will reveal this desired result.

Sodium bicarbonate cannot be given subcutaneously because if the solution is boiled to make it sterile carbonate of sodium is formed which will produce a slough. Sodium bicarbonate solution should be freely given by the mouth if the stomach will tolerate it.

CHOLERA MORBUS.

This acute, painful, rapidly exhausting disorder arises from exposure to cold, the ingestion of poisonous or irritating foods, exposure to excessive heat, and a number of similar causes.

In reality, it may be regarded in one instance as a gastro-enteritis, and in another as an acute serous diarrhea associated with much pain of a griping, rending character. Nothing compares to counter-irritation and morphine hypodermically for the purpose of affording relief. A large mustard or capsicum draft should be placed over the abdomen and allowed to remain as long as it can be borne. If the patient knows that he has taken irritant foods, $\frac{1}{2}$ ounce (16.0) of castor oil with 15 to 20 minims (1.0–1.3) of laudanum added to it, to prevent griping, should be employed to sweep out the offending masses before any other remedies are used, and be followed after it acts by an antidiarrhea mixture, such as the following:

℞—Acidi sulphurici aromatici		f ʒij vel f ʒiv (8.0–16.0)
Fluidextracti hæmatoxyli		f ʒiv (15.0)
Spiritus chloroformi		f ℥ss (16.0)
Syrupi zingiberis	q. s. ad	f ℥iij (90.0).—M.

S.—Dessertspoonful (8.0) every two hours.

If the pain is very severe, the patient should be given morphine (gr. $\frac{1}{4}$ [0.015]) and atropine (gr. $\frac{1}{150}$ [0.0004]) hypodermically. (See articles on Diarrhea and Cholera, Asiatic.)

CHOREA.

St. Vitus' dance is a nervous affection, generally occurring in children, yielding to treatment quite readily in some cases, and in others remaining persistently severe, and even becoming worse, under the physician's care.

The disease is always to be treated by the removal of all sources of reflex irritation, such as worms, a long prepuce if it is irritated by retained urine or smegma, or other trouble of this character, and in the avoidance of punishment or severe rebuke on the part of the attendants. This advice is given not because chorea is produced by such irritating conditions, but because they tend to impair the nervous tone of the patient. Except in that form of the disease closely associated with or dependent upon rheumatism, the profession universally employs arsenic in one of its forms as a specific remedy. Generally Fowler's solution is used, and, unless the parents are intelligent enough to drop medicine carefully from a bottle or dropper, the physician should order a 3-ounce mixture (90.0) with 60 minims (4.0) of Fowler's solution, so that each teaspoonful will contain a little less than 3 minims of the drug. Very frequently, to be effective, arsenic must be used in ascending doses, increased 1 minim (0.06) a day, and in consequence the dilution just spoken of is to be avoided, and the importance of care in measuring the pure drug impressed upon the patient's relatives.

When arsenic is used the physician should instruct the attendants to stop administering the drug if any puffiness under the eyes is seen in the morning on arising from bed, or if any pain in the bowels ensues, as these symptoms show that the full medicinal action of the drug is being felt.

When arsenic fails, cimicifuga in the dose of 20 to 30 minims (1.3–2.0) of a fresh fluidextract for a child of ten years may be used as the next best remedy.

When the disease is associated with rheumatism, recent or remote, large doses of the salicylates, particularly novaspirin, or aspirin, may be of value, and should be thoroughly tried.

In some cases of chorea the muscular jerkings are so severe that sleep is impossible, and the patient has to be held in bed and the bed-covers tied down. These cases will often obtain a quiet night by the use of the hot pack at bedtime. (See Heat.) The child should be placed in a blanket previously dipped in water as hot as can be borne by the patient and thoroughly wrapped up in another (dry) blanket to retain the heat, and then be allowed to sweat. Care must be taken that a heat-stroke does not result, and, if sweating does not come on and oppression ensues, the blanket must be removed. The sheets should be ironed to have them warm for the patient when she is returned to bed, and it is often better to let her sleep between dry blankets. The efficacy of this treatment is increased by the use of a dose of bromide of sodium or potassium and a little chloral, as follows:

℞—Chlorali hydrati . . . . ʒj (4.0)
Sodii bromidi . . . . ʒij (8.0)
Aquæ destillatæ . . . . q. s. ad f℥iij (90.0).—M.
S.—A dessertspoonful (8.0) in water every five hours for three doses.

In other instances, 3 to 5 grains (0.15–0.3) of barbital sodium, dial or even luminal, grain 1 (0.06) are advantageous.

CHOROIDITIS.

Choroiditis, or inflammation of the choroid, may depend upon constitutional disorders, infections, toxins and traumatisms, or upon diseases in other portions of the eye. Common varieties are syphilitic, tuberculous and traumatic choroiditis. A number of types of acute choroiditis are due to bacterial elements arising from local areas of sepsis in the teeth, tonsils, nasal passages and nasal accessory sinuses, the intestines and the prostate.

The treatment depends upon the recognition of the cause and the subjects of choroiditis should be thoroughly examined from the laboratory and general standpoint. Mercury, iodides and other alteratives are usually indicated; great care should be exercised to search for and eliminate focal infections. Inasmuch as tuberculosis is a common cause of choroiditis, should the influence of this etiological factor be demonstrated, tuberculin therapy, other things being equal, is indicated and sometimes achieves satisfactory results.

In acute types of choroiditis atropine mydriasis (grs. iv-f℥j) is of service provided there is no rise of intra-ocular tension—a not infrequent complication. Locally, ethylmorphine-hydrochloride (dionin), 2 to 5 per cent solution, is useful in the form of drops.

COLIC (HEPATIC).

This exceedingly painful condition, due to the engagement of a gall-stone in the bile-duct, is usually associated with faintness and nausea.

The object of the physician must be to relieve the pain, not only by the use of anodynes, but also by aiding in the escape of the stone into the bowel. To relieve the pain a hypodermic injection of morphine, $\frac{1}{4}$ to $\frac{1}{2}$ grain (0.015–0.03), accompanied by $\frac{1}{100}$ grain (0.0006) of atropine, is indicated. The morphine not only decreases the pain, but allays spasm, and the atropine relaxes the spasm of the muscular coats of the ducts and allows the stone to pass through the relaxed passage-way. Hot applications, such as turpentine stupes, may be used over the liver, but relaxation is *not* to be obtained by the use of nauseating emetics, as the retching or vomiting may rupture the distended gall-bladder. Energetic rubbing should not be used for the same reason.

For years the use of olive or cotton-seed oil has been largely resorted to in this affection, and while we are not sure of the manner in which it acts, the studies of Rosenberg and others point to the changing of the oil into glycerin and fatty acids, the first of which liquefies and increases the flow of bile. Often the large dose of oil causes nausea, and this, by producing general relaxation, may aid in the escape of the stone. The oil is used during the attack of pain, and must be swallowed in the dose of $\frac{1}{2}$ pint at least; small quantities do not suffice. Its action may be aided and its retention in the stomach promoted by the addition of a dram of ether to each dose.

Shortly after the oil is swallowed sudden relief often occurs, due, perhaps, to the escape of the stone into the bowel. The stools should then be carefully watched for gall stones, but care should be taken that the lumps of soap which are passed, made from the oil by the alkaline juices in the intestines, are not mistaken for true biliary calculi.

If the pain does not yield to morphine, chloroform or ether may be inhaled for the relaxation of the spasm and the relief of pain.

After the acute attack is over, calomel in small divided doses of a fraction of a grain may be given several times a week, or nitrohydrochloric acid may be used. In other instances, where there is reason to believe that the flow is sluggish and the bile not sufficiently alkaline, and that catarrh and putrefactive tendencies are present, the administration of benzoate or salicylate of sodium, in 10- or 20-grain doses, will result in increasing the flow, increasing the alkalinity, overcoming the catarrh, and then arresting intestinal putrefaction. If the catarrhal process is very marked, chloride of ammonium will act even more satisfactorily. This treatment seems especially valuable when the stones that are passed are very dark in color, indicating that much pigment and little cholesterin is present. In respect to the use of alkalies, the patient should drink freely of those mineral waters which will provide alkaline substances, such as Contrexeville, Vichy, and Kronenquelle, and it is useful in many such cases to relieve any tendency to constipation or duodenal catarrh by the administration of hot Carlsbad water before breakfast daily.

In the matter of regulating the diet, all rich or fatty foods are to be prohibited. Meat should be used in moderation, no game ingested, and green vegetables largely eaten.

If attacks of gall-stone colic are frequent enough to incapacitate the patient, or if fever, pain and tenderness in the region of the gall-bladder is severe or constant, surgical relief is demanded.

CONJUNCTIVITIS.

Simple Conjunctivitis, often called catarrhal, acute, or mucopurulent conjunctivitis is characterized by congestion of the conjunctiva, loss of transparency of the palpebral portion, and some dread of light, with a discharge, sufficient only to glue the lids in the morning, or free and mucopurulent. Staphylococci, streptococci and pneumococci are usually present in the secretion. Commonly an independent affection, it also may be associated with rhino-pharyngitis, bronchitis, facial eczema and the exanthemata, especially measles. In the milder stages the use of a boric-acid lotion (10 grains to the ounce [0.6 :30.0]) or a mixture of boric lotion and physiological salt solution is suitable, and the lids should be frequently washed with a neutral soap and water; if there be much mucopurulent discharge, the eye-lids should be everted and an application made of a solution of nitrate of silver (from 2 to 5 grains to the ounce [0.12–0.3 :30.0]). If the discharge becomes profuse bichloride of mercury, 1 to 10,000, or mercurophen, 1 to 20,000, may be employed with advantage, or the nitrate of silver application increased to 10 grains to the ounce (0.6 :30.0), the excess being neutralized with a solution of salt or washed away with tepid water. In place of nitrate of silver argyrol is much used and may be employed in a strength varying from 10 to 25 per cent, according to the severity of the symptoms. Neo-silvol (15 per cent) is also useful. Much inflammatory reaction in this disease may be alleviated by frequently changed ice compresses. Patients suffering from catarrhal conjunctivitis should be protected from tobacco smoke, bright light, dust, or any mechanical irritant. Atropine usually is unnecessary unless a corneal ulcer complicates the affection. The patient may wear smoked glasses, but *in no circumstances should the eyes be bandaged or have poultices applied to them.* Domestic medication of this sort may change a simple conjunctivitis into a serious and purulent inflammation. Topical medications other than those mentioned are biborate of sodium (gr. iv–viij to the ounce), sulphate of zinc (1 to 2 grains to the ounce [0.06–0.12 to 30.0]) which may be suitably combined with boric-acid solution. Mucopurulent conjunctivitis may become epidemic in crowded institutions, and great care should be taken to isolate cases. One soiled towel may be the source of infection to a great number of children. Usually in such circumstances the conjunctivitis assumes one or other of the types noted in the next paragraph. Constitutional treatment ordinarily is not required, but proper hygiene, fresh air, good food, the intelligent use of laxatives, and tonic doses of quinine are useful.

Acute contagious conjunctivitis, vulgarly known as "pink eye," does not greatly differ in its manifestations from pronounced type of simple conjunctivitis, except that it is more violent and is apt to be associated with hemorrhages beneath the conjunctiva. The secretion at first thick and ropy, being gathered into strings of muco-pus, soon becomes distinctly purulent As its name indicates, it is highly communicable, and sometimes appears in an epidemic form. It is due, in the great majority of instances, to the Koch-Weeks bacillus. A very similar form of epidemic conjunctivitis is caused by the pneumococcus, and is often difficult to distinguished from Koch-Weeks bacillus conjunctivitis except by bacteriological examination. A form of conjunctivitis due to Pfeiffer's bacillus, may be a complication of influenza, and is more often encountered in children than in adults. The treatment is the same as that already described. A solution of sulphate of zinc, 1 or 2 grains to the ounce, is preferred by some surgeons.

Conjunctivitis due to the Morax-Axenfeld bacillus, although usually subacute in character, may appear as an acute manifestation. Solutions of sulphate of zinc (gr. i-iv to f℥j) (0.05–0.2–30.0) are practically specific in their action in this disease; the silver salts are of no use.

Purulent Conjunctivitis occurs in three specific forms: In the newborn (conjunctivitis neonatorum, or ophthalmia neonatorum), in young girls (gono-blennorrhea of young girls), and in adults (gonorrheal conjunctivitis, or ophthalmia).

Conjunctivitis neonatorum is caused by the introduction into the eye of infecting material from some portion of the genito-urinary tract of the mother, at the time of or shortly after birth. The majority of cases, and all severe forms, are associated with a special microörganism, the gonococcus of Neisser, and the secretion in the eye of any new-born child should always be promptly examined bacteriologically. The prognosis is always grave in gonorrheal cases, but with competent medical attendance, and if the eyes come under treatment while the cornea is still clear, except in certain types with inherent malignancy, or where depreciation of nutrition or intercurrent illness diminish the resisting power of the child, the disease should be brought to a successful termination. Failure to check the disease or any neglect in its management may result in severe corneal ulceration and its sequels—leukomas and staphyloma. Conjunctivitis neonatorum is the cause of about 8 to 10 per cent of the total number of cases of blindness in this country. Fully 25 per cent of the inmates of asylums for the blind have lost their sight from this disease. In order to remove the discharge, the lids should be gently separated and the conjunctival sac irrigated with a saturated solution of boric acid, and this irrigation repeated as frequently as is necessary to free the conjunctival sac from purulent secretion. To check the discharge nitrate of silver may be applied to the everted lids once a day by means of a cotton mop in a strength of 2 per cent, and its excess neutralized with a physiological salt solution. The application of white vaseline to the edges of the lids is useful as a protecting agent. Because of its irritating qualities, and because skilled hands are not always to be commanded in this disease, nitrate of silver has in recent times been largely substituted by argyrol and protargol. Of the former remedy, a 25 per cent solution should be dropped freely into the conjunctival sac, so that the surfaces of the inflamed conjunctiva are kept constantly bathed in the fluid. (See Immersion Method.) Argyrol has only a limited bactericidal power, but is bland, and has the property of floating to the surface the mucus and pus, and thus rendering their removal easier than would otherwise be the case. If this does not check the discharge, its action should be supplemented by an application of nitrate of silver (2 per cent) to the everted lids in the manner already described, great care being taken not to injure the cornea and therefore the applications should be made by the physician himself or by a trained nurse. In place of argyrol, protargol in 10 per cent solution may be substituted, but it is more irritating than argyrol and not superior in any respect to nitrate of silver. The application of cold compresses during the early stages is often most useful, but it requires much experience to determine whether cold should be used, as not all cases are suited to its employment. Atropine drops (0.5 per cent) twice a day may be used if corneal ulcer results. Recently frequent irrigations with ice-cold normal salt solution has been recommended. (Heckel.) About 25 per cent of the cases of conjunctivitis neonatorum are due to microörganisms other than the gonococcus, chiefly the pneumococcus, and require the treatment already detailed in the section devoted to non-gonorrheal conjunctivitis.

The prophylaxis of ophthalmia neonatorum is best secured by the employment of the method which was instituted by Credé, namely: As soon as the head of the child is born, the lids are carefully cleansed, parted, and 2 drops of a 2 per cent solution of nitrate of silver are instilled into each conjunctival sac. Small cold compresses are then laid upon the lids and renewed at suitable intervals. This method should be employed in all infected cases and in cases from which the suspicion of infection has not been removed, but it is unnecessarily severe if previous examination has demonstrated the entire absence of infection. Under the last-named conditions careful cleansing of the lids of the eye and flushing of the conjunctival sac with a mild antiseptic lotion are sufficient. Neither protargol nor argyrol is a suitable prophylactic substitute for nitrate of silver in infected cases, but it is safe to reduce the strength of the nitrate of silver solution to 1 per cent.

Gonorrheal conjunctivitis of adults, provided the patients are robust and the cornea unaffected, should be treated in the early stages by the application of iced compresses, either constantly, or else for twenty minutes at a time every two or three hours. Usually their application is inadvisable after the first thirty-six hours. Great care should be exercised in removing the quickly accumulating discharge in the manner already described, and this removal is facilitated by keeping the conjunctival sac immersed in a 25 per cent solution of argyrol. This drug, however, is in no sense a specific, and its action should be supplemented by a daily application of nitrate of silver, in the manner already described, and in the same strength. In place of argyrol, protargol, in 10 to 20 per cent solution, may be employed in the same manner as the argyrol, and in the experience of some clinicians has proved of greater value than the argyrol, or than the argyrol plus the nitrate of silver. In the writer's experience, however, nitrate of silver, either with or without the addition of argyrol, remains a sovereign remedy. In certain severe cases, following the recommendation of Kalt, the disease may be treated with copious irrigations of permanganate of potassium, 1 to 5000, four or five times a day, and in suitable cases this furnishes excellent results. Always, if there is corneal involvement, which is only too apt to occur, and even before its appearance, atropine should be used with sufficient frequency to keep the pupil dilated and to reduce the hyperemia of the iris and ciliary body. Scarification of the chemotic ocular conjunctiva has been recommended, but must be practised with great care lest the cornea be injured. The prognosis is much more grave in this disease than in ophthalmia neonatorum, and in a very large percentage of the cases, even under the best treatment, corneal ulcers and consequently corneal scars and even staphyloma are the result.

Occasionally young girls are the subject of vaginitis, which in severe form is associated with a purulent discharge, and in hospitals and asylums may be the cause of an epidemic of severe purulent conjunctivitis. In some of these cases gonococci are present in the discharge. The treatment should in all respects conform to that which has been described in connection with ophthalmia neonatorum.

Chronic Conjunctivitis may result from an antecedent acute inflammation of the conjunctiva or exist as an independent affection, especially in elderly people, in whom it sometimes becomes a troublesome symptom. The characteristic lesions are roughness of the papillæ of the conjunctiva, swelling of the caruncle, and soreness of the angles of the eyelids. There are no granulations, although the disease is sometimes inaccurately spoken of as granular lids. A soothing lotion is indicated (10 grains of boric acid to the ounce [0.6 to 30.0] of water), to which may be added 4 grains (0.12) of biborate of soda and for which a similar boric-acid lotion with 4 grains (0.25) of salt to the ounce (30.0) may be substituted. A very suitable local application is *lapis divinus* (sulphate of copper 1 part, alum 1 part, nitrate of potassium 1 part, fused together, and camphor equal to one-fiftieth of the whole added); the mass is run into sticks, and the application made to the everted lid. Other useful applications are tannin and glycerin (10 grains [0.6] to the ounce [30.0]) and alum crystal. If refractive error exists, this should be corrected. Chronic conjunctivitis distinctly contraindicates any operative interference in the eye, as, for instance, cataract extraction. There is an interesting form of chronic conjunctivitis, or, more accurately, subacute conjunctivitis, which runs a course lasting from eight weeks to several months, and which is characterized by moderate objective symptoms, due to the presence of the diplobacillus of Morax and Axenfeld, and which is promptly cured by the application of a solution of sulphate of zinc, 1 or 2 grains to the ounce. The conjunctival secretion of stubborn cases of conjunctivitis should always be examined for this bacillus.

Lacrimal Conjunctivitis is a name given to a chronic form of inflammation of the conjunctiva associated with obstruction in the lacrimal duct, and characterized by a tear-soaked appearance of the eye, small pustules at the roots of the lashes, and a gummy discharge along the palpebral margin. This can be cured only by relief of the stricture of the nasal duct which causes it, but may be alleviated with the same remedies recommended in the treatment of chronic conjunctivitis.

Follicular Conjunctivitis.—A disease sometimes mistaken for trachoma, but having a distinct clinical difference, inasmuch as the swollen follicles are absorbed without the production of cicatricial changes in the conjunctiva—requires for its local treatment astringents and antiseptic lotions, and the application to the swollen follicles of an ointment of sulphate of copper (gr. $\frac{1}{2}$ to the dram [0.03 to 4.0]). If the disease is stubborn, the swollen follicles should be crushed with suitable expression forceps. This conjunctival affection may prove to be very troublesome in schools and asylums. Often it is difficult to differentiate it from trachoma.

The disease, or one analogous to it, is sometimes produced by the prolonged instillation of atropine, and less frequently by eserine and cocaine. If this is its cause, the drug must be suspended and the surface painted with an alum crystal.

Trachoma.—This disease is characterized by an inflammation of the adenoid layer of the conjunctiva, associated with the development of the trachoma bodies or granulations and enlargement of the papillary layer. After absorption and metamorphosis of the inflammatory material, cicatricial changes develop and the disease may be complicated with distortion of the lid, incurvation of the lashes, and ulceration and bloodvessel formation in the cornea (pannus). In the early stages the enlarged follicles, or trachoma bodies, are chiefly located in the retrotarsal folds, are of a grayish-white or yellowish color, and they have been compared to frog-spawn owing to their appearance. Later they are hidden by the swollen conjunctiva and changed in appearance by the matamorphosis of their contents. In certain stages the disease, especially if associated with purulent secretion, it is markedly communicable, and is therefore notably dangerous in schools, camps, cantonments and in any institution where large numbers of inmates are gathered together. Its detection by those who inspect immigrants is of the utmost importance, in order that its spread may be limited. If the disease is associated, as is often the case, with a mucopurulent secretion, the conjunctival sac should be frequently cleansed with a saturated solution of boric acid, or with a solution of bichloride of mercury, 1 to 8000, or cyanide of mercury, 1 to 5000, and nitrate of silver, or argyrol, or protargol may be employed to check the purulent discharge, care being taken that the applications are not too prolonged lest they cause staining of the conjunctiva (argyrosis). After the discharge has been checked, or in those cases in which it does not exist, the everted lid may be touched with a crystal of sulphate of copper, or with a solution of tannic acid, 30 grains to 1 ounce of glycerine, or with one of boroglyceride, 20 to 50 per cent. In place of sulphate of copper, copper citrate in 5 per cent ointment, introduced into the conjunctival sac with the aid of gentle massage, is of service. A 5 per cent solution of sulphate of copper in glycerine is useful. Numerous other antiseptic and astringent remedies have been employed, namely, phenol, hydrastin, iodide of silver, ichthargon, 2 to 3 per cent, ichthyol, and, indeed, almost any remedy of this nature whose application is suited to the ocular surroundings.

The best results, however, are obtained by surgical measures, the mildest of which consist in some form of expression operation, by means of which the trachoma bodies are squeezed with suitable forceps from their lodging place in the conjunctiva, and the lids subsequently treated according to the principles already enunciated. Other surgical procedures consist in scarification, followed by brushing of the conjunctiva with a solution of bichloride of mercury, 1 to 2000, electrolysis, and excision of the fornix conjunctivæ and in chronic cases of the tarsal plate. Roentgen-rays and radium and phototherapy are recommended by some surgeons in the treatment of trachoma, but suitable surgical procedures produce the best results, and if properly applied cure a large percentage of cases. There are many elaborate operations for the cure of trachoma, such as partial and total excision of the tarsus, the descriptions of which cannot be inserted and special ophthalmic treatises must be consulted.

Vernal Conjunctivitis (Fruehjahr's catarrh), characterized by photophobia, mucous discharge, granulations in the palpebral conjunctiva and a hypertrophy of the tissue about the limbus, appears chiefly in the warm months and disappears in cold weather. The usual treatment of conjunctivitis is suitable, but has only a temporary effect; protection from heat and change from a warm to a colder climate are most likely to meet with success. The use of adrenalin chloride (1 to 10,000) is often advised; it can have only a temporary effect. Radium, applied by an expert, is the best remedy for the cure of stubborn types of this affection. Fibrolysin, as suggested by Luedde, often acts advantageously. He used it as follows: A 2 per cent solution of phenocain (holocain) is instilled, next the lids are everted and painted with 0.2 per cent solution of nitrate of silver followed, and after its neutralization, by an application of fibrolysin by means of a cotton-wound probe.

Diphtheritic Conjunctivitis may appear alone or in association with diphtheria of the throat and nose. The initial subjective symptoms are those of purulent ophthalmia; the characteristic objective symptoms, a board-like infiltration of the lids with a deposit of gray membrane upon the palpebral conjunctiva. More than in any other eye disease destructive inflammation of the cornea is threatened. In the early stages the eye should be frequently cleansed with boric acid or bichloride of mercury solution, and atropine drops should be instilled. The constitutional measures for diphtheria are necessary, and the best treatment is the employment of injections of diphtheria antitoxin.

Chemosis of the Conjunctiva, in which this membrane is infiltrated with serum, is usually a symptom of other ocular disorders, and subsides under the general treatment directed to their relief. It is a common sign of diseases of the nasal accessory sinuses. Angioneurotic edema of the conjunctiva may appear without apparent cause and with marked suddenness. Good results may follow nicking the swollen tissues with a pair of scissors, the application of a warm, moist compress, and the use of astringents, especially alum.

Hemorrhage Beneath the Conjunctiva (subconjunctival ecchymosis) may follow an injury, occur during a paroxysm of whooping cough, and occasionally, in elderly people, may appear spontaneously. Recurring subconjunctival hemorrhages in old people are indicative in many instances of renal disease and arteriosclerosis, having much the same significance as hemorrhages in the retina. No treatment materially hastens absorption of the blood, unless it be massage of the globe through the closed lid; any associated conjunctival irritation indicates a boric-acid collyrium.

Burns of the Conjunctiva.—All foreign substances must be removed at once, and if lime has been the injuring agent, this is best accomplished by forcible irrigation of the conjunctival sac with clean water. For acid burns an alkaline lotion is usually recommended. The subsequent treatment consists in the instillation of olive or castor oil, and atropine drops to prevent secondary iritis if the cornea is much inflamed; atropine may be incorporated with liquid vaseline and placed in the cul-de-sac. To prevent the formation of symblepharon the adhesions forming between the bulbar expanse and inner surface should be daily parted by means of a blunt probe, and the cul-de-sac kept filled with boric-acid salve. Powder grains are frequently imbedded in the conjunctiva; they cannot be picked from their beds; usually the larger ones can be excised.

CONSTIPATION.

This troublesome state depends on a number of causes, the most common of which is the following of a sedentary life, devoid of the exercise intended to keep the intestinal and hepatic secretions in an active state. Another frequent cause is simple laziness, which causes the patient to resist the call of the bowel for evacuation until this part of the body becomes indolent and atonic, while modesty often causes constipation in females, because a woman prefers to suffer rather than go to a closet which may be somewhat publicly situated. In other instances it is due to enteroptosis, or depends upon deficient nerve energy or muscular weakness and lack of secretion in the lower bowel, or upon hepatic torpor. When due to enteroptosis, which is more commonly met with in multipara or in stout women who have grown thin, abdominal support should be given by a belt which holds up the abdominal contents or by adhesive straps.

Whatever the causes are, they should be sought for, and, if possible, removed, the physician not being content to order purgatives, which, while they may give temporary relief, soon lose their power.

Further than this, it must be remembered that hygienic measures always take first place in the method of treatment, and, if possible, drugs should occupy a very secondary *rôle*. Particular attention should be paid to diet, and the physiology of peristalsis must be well borne in mind.

It has been proved by a large number of studies, both in the normal intestine and by the use of purgatives, that peristalsis is almost entirely a reflex action depending for its existence upon the integrity of the nervous plexuses in the intestinal walls—namely, those of Auerbach and Meissner—the first of which are situated between the longitudinal and circular muscular fibers which they supply, the latter existing in the submucosa and supplying the walls of the villi, the glands of Lieberkühn, and the small arteries and venules.

It has also been found that the vagus nerve, when stimulated reflexly or directly, increases peristalsis, and that moderate stimulation of the splanchnic nerve decreases it.[1] It at once becomes evident that any decrease in the normal activity of these nerves and nerve centers must speedily result in constipation, and the costive condition consequent upon hepatic torpor is due to the fact that the intestinal walls do not receive the proper stimulation from the bile to set in motion a reflex peristaltic wave, the result of which will be evacuation. This fact rests upon the results of direct experiments, which prove the bile to be primarily an intestinal stimulant, antiseptic, and promoter of secretion.

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[1] Some persons believe that Meissner's plexus receives impulses from the walls of the intestine and transmits them to the motor plexus of Auerbach, which then sets in motion peristalsis.

Other series of experiments have shown that the circulation of the blood through the intestines greatly influences peristalsis, and disorders in the blood supply readily bring on intestinal disorder.

The deductions to be drawn from these facts are many. In the first place, it is evident that the maintenance of an active, normal circulation of blood in the abdomen and a free pouring out of bile from the liver and gall-bladder are necessary to a healthy peristalsis; and we find that, aside from drugs, there are a number of remedial measures which may be resorted to according to the means of the patient. By far the best of these is horseback exercise for at least an hour a day or every other day, which by the motion actively stirs up and excites the abdominal viscera as no other measure can do. If for any reason horseback exercise is impossible, then abdominal massage, carried out by a capable "rubber," is to be tried, the hands following more particularly the course of the ascending, transverse, and descending colon, the kneading movements being also applied to the hypochondriac regions. If neither of these measures can be used, then the patient must resort to those gymnastic movements which involve the abdominal muscules, either by the use of dumb-bells or pulleys, such as are sold under the name of "home gymnasiums," or by bending the body forward, backward, and laterally, with the fists pressed into the hypogastrium. (For movements, see Inhalations, Part III.)

At the same time that these measures are directed the diet of the patient must be so regulated that the food shall contain a large amount of residue—that is, after digestion enough of the husk of the grain or enough vegetable fiber must be left free in the intestines to form a stimulus to the intestinal wall as it slips over the mucous membrane. If a meat diet is largely used, so little residue is left after digestion that constipation ensues, but if vegetables are largely eaten, the reverse is the case. No better evidence of this can be adduced than the hard, clay-like passages of the dog and the soft passages of the cow. Very often a plateful of cracked wheat (wheaten grits) eaten at breakfast each morning, or the use of bran bread, will relieve a tendency to chronic constipation. In these cases milk as a prominent article of diet is to be avoided above all things, since it is almost entirely assimilated and leaves no residue, though it supplants other foods. Green or canned corn is of great service. Fruits do good in constipation in one of two ways—they contain either residual materials or sufficient vegetable acid salts to be laxative. Figs, by reason of their many small seeds, which scrape the mucous membrane during peristalsis, are particularly valuable, and apples, prunes, dates, and tamarinds are all useful. Agar-agar is useful and liquid petrolatum of the heavy type is beneficial when the stools are dry, as it acts as a lubricant and keeps the stools soft. It must be remembered that strawberries, raspberries, and blackberries are generally constipating rather than purgative. In regard to drink, nothing is so good as a glass of cold water taken on arising in the morning or just before breakfast, or, if the cold cannot be borne, than a glass of as hot water as can be swallowed with comfort may be substituted. Coffee is constipating to most persons, largely because of its empyreumatic oil, and tea has the same tendency because of its tannic acid. Brandy, as every one knows, is distinctly constipating, and whisky possesses so little power to the contrary as to be devoid of influence in either direction. Beers differ in their properties, some of them increasing and some of them decreasing intestinal activity.

The patient suffering from constipation should go to stool regularly after breakfast every day even if the attempt is abortive, and so train the bowels to having a movement at this time.

The use of drugs for the relief of constipation is capable of division into two parts: First, the employment of remedies to unload the bowel, which has become filled; second, the use of drugs which will so influence the intestines as to cause evacuation and produce normal activity, or, in other words, drugs which will cure the tendency instead of giving temporary relief. Of the first class we find the various purgative salts, jalap, colocynth, senna, mercury, castor oil, and rhubarb; of the second class, aloes, cascara sagrada, phenolphthalein, rhamnus frangula (buckthorn), phosphate of sodium, and small doses of podophyllin. The physician should bear in mind that defecation is a normal physiological act which must be continued all through life, and it is almost as foolish to stimulate the bowel continuously to peristalsis as perpetually to employ heart stimulants or respiratory excitants.

Although habitually employed by many persons in daily doses, the purgative salts if given in concentrated form are exceedingly harmful in such instances, rapidly losing their power and decreasing the patient's strength by the abstraction of liquids and salts from the blood. They often produce anemia when constantly used. These salines are to be employed simply to unload the bowel when an excess of fecal matter has accumulated or when irritant materials are to be swept out of the alimentary canal. In some cases of pelvic congestion associated with constipation magnesium sulphate may be given by enema in the proportion of 2 ounces (60.0) of the salt, 1 ounce (30.0) of glycerin, and 4 ounces (120.0) of water. In other instances, particularly where plethora exists, a course of Pluto water, Carlsbad or other waters, which depend chiefly upon magnesium and sodium sulphate for their activity, is of service. When used habitually they should be diluted with hot water and given one-half hour before breakfast. The patient should then take some exercise before taking food. Jalap, colocynth, and senna are not to be used constantly, as they are too active and the reaction from their effects causes constipation. Rhubarb is commonly used, but is of its class peculiarly unfitted to its task. Although it purges, it is distinctly astringent, and is therefore constipating afterward.

Mercury is exceedingly harmful if used continuously as a purge, and may be the cause of much ill health, of decayed teeth, and of digestive troubles. Castor oil is notorious for its tendency to cause ultimate constipation. It is to be used to clear out the bowels and not be employed continuously.

Of the curative class of laxatives none compares to cascara sagrada, particularly in the form of the aromatic fluidextract or cascara cordial. Originally this drug, as prepared, was very bitter, but it is now made almost tasteless by certain manufacturers. This is the only drug which alone moves the bowels and at the same time tends to make future passages more easy and regular; the dose is 10 to 40 minims (0.6–2.6) of the fluidextract or 1 to 6 drams (4.0–24.0) of the cordial. There is almost no griping produced by it. For regulation of the bowels of young children, particularly if the case have a tendency to rickets, phosphate of sodium in the dose of 5 to 10 grains (0.3–0.6) in milk is a useful laxative, and the same salt may be used in 30- to 60-grain (2.0–4.0) doses in adults. Phenolphthalein in the dose of 1 to 2 grains (0.06–0.12), taken at night, is an excellent laxative. The two remaining drugs of this class, aloes and podophyllin, should always be used in combination with other non-purgative drugs, as is seen in the following formulæ:

℞—Aloes purificati	gr. xx vel xl (1.3-2.6)
Extracti nucis vomicæ	gr. iv (0.25)
Extracti physostigmatis	gr. iij (0.2)
Extracti belladonnæ	gr. iv (0.25).—M.

Fiant pilulæ, No. xx.
S.—One or two pills at night or night and morning.

Or,

℞—Resinæ podophylli	gr. ij vel iv (0.12–0.25)
Extracti nucis vomicæ	gr. iv (0.25)
Extracti physostigmatis	gr. iij (0.2)
Extracti belladonnæ	gr. iv (0.25).—M.

Fiant pilulæ, No. xx.
S.—One pill night and morning.

The object of using several of these drugs is seen at a glance. The nux vomica acts as a bitter tonic and stimulant, and prevents subsequent atony of the mucous membrane, as well as increases reflex action, and consequently improves peristalsis; the physostigma is a tonic to the unstriped muscular fiber and gives it strength; the belladonna aids peristalsis by depressing the inhibitory fibers of the splanchnic nerves, by allaying spasm, and by decreasing griping. In using these drugs, aloes and podophyllin, it should be remembered that aloes is slow and acts particularly on the lower bowel, and that podophyllin is the slowest in the list of purges. (See Phenolphthalein.)

In obstinate constipation we are sometimes forced to resort to the compound cathartic pill of the U. S. P. After the bowels have been well emptied by this pill we can often regulate them by cascara sagrada with or without other laxatives, and by prescribing a proper diet and exercise. Liquid petrolatum is very often useful in the dose of 1 to 2 tablespoonfuls once or twice a day with or without agar.

In the flatulence of old persons associated with constipation a little asafœtida and capsicum should be added to the pill of aloes just named.

In some instances constipation arises from reflex irritation as from ovarian or bladder trouble or from chronic lead poisoning. This form of constipation may resist all purgatives and yield to opium or to tobacco, which quiet reflex action. In patients with enteroptosis constipation the use of a supporting belt is often of great service.

In still other instances no definite focus of reflex irritation is found, but the constipation seems to be due to fixation or spasm. In these cases hyoscyamus or belladonna should be given freely.

The employment of enemata as a routine practice is to be discouraged. In cases where it is necessary to use them for temporary relief and to get rid of flatulence, a little soap, common salt, or a few drops of turpentine may be added to the water.

The injection of glycerin (1 to 2 ounces [3.00-60.0]) has been largely resorted to, either pure or diluted one-half, and this method has been improved upon by the use of glycerin suppositories containing many drops of the drug. Glycerin acts in these cases as an irritant to the mucous membrane, and causes secretion by this means and by its abstraction of water from the tissues by reason of its hygroscopic powers. It is capable, however, of causing a good deal of rectal irritation in some persons.

Much has been written on auto-intoxication resulting from constipation, and radical surgical operations resorted to for relief. I heartily endorse these words of Woolley:

1. Absorption of bacteria and other substances from an unhealthy bowel may produce serious symptoms.
2. A surgical operation for intestinal stasis is not justifiable except as a last resort.
3. There is no definite information in the literature to show that surgical procedures, made for intestinal stasis, have been more successful than medical (including hygienic) ones.
4. Many cases in which symptoms are attributed to intestinal stasis are suffering from focal infections entirely outside the intestinal tract. Such infections are illustrated by pyorrhea alveolaris, chronic tonsillar infection, and chronic infections of the antra and sinuses of the head.

CONVERGENT SQUINT.

Convergent squint, or strabismus ("crossed eyes" in common parlance) usually begins between the third and fourth years of life, although it may be present at an earlier period. It is caused by disturbance of the relation between accommodation and convergence by errors of refraction, by inequality of the vision of the two eyes due to amblyopia of one of them, and by defective development of the fusion faculty.

Treatment should begin as early as possible in order to prevent increasing amblyopia and to encourage the restoration of binocular vision. Hence an accurate correction of the refractive error is necessary, and the glasses should be worn constantly; also educative treatment by occlusion or atropinization of the *fixing* eye and stereoscopic exercises. Such methods often "cure the squint," that is, produce parallelism of the visual axes. The statement only too often made that the child will "outgrow the squint" is wrong, and represents very bad advice.

CORNS.

These troublesome formations are best treated by the use of salicylic acid, the following formula being applied night and morning for several days, after which the part should be well soaked in hot water, when the entire corn will readily come away, but in some cases several attempts will be necessary:

℞—Acidi salicylici	gr. xxx (2.0)
Extracti cannabis	gr. x (0.6)
Collodii	f℥ss (16.0).—M.

S.—Apply with a camel-hair brush.

The same acid may be used in alcohol, and lactic acid in the same proportion is often of service.

In the so-called "soft corns," with much inflammation, the foot should be washed and dried, and a saturated solution of nitrate of silver, 60 grains (4.0) to 2 drams (8.0) applied to the part every four or five days.

CORYZA (ACUTE).

The treatment of coryza of the acute variety, the form which most frequently presents itself to the physician for relief, is followed in many instances by such marked amelioration of the symptoms and shortening of the attack as to encourage medical interference. It must be remembered, however, that the duration of the condition before the patient presents himself has much to do with the prognosis, for if the tissues of the nasal chambers have become boggy and swollen with exudate recovery must be more delayed than if remedies are applied in the early stages of the catarrhal process. The local treatment consists in the following measures for relief: By means of an atomizer a few minims of a 4 per cent solution of cocaine are sprayed into the nostrils, the patient's head being well tipped back. If there is any contraindication to cocaine, adrenalin 1 to 10,000 may be used in many cases or ephedrin hydrochloride in 2 per cent solution. After the constringing influence of the cocaine has shrunken the congested mucous membrane so that the patient can draw air through the nostrils, the nasal chambers should be washed clean of mucus by means of the following lotion in an atomizer:

℞—Sodii chloridi	gr. xv (1.0)
Acidi borici	gr. x (0.6)
Sodii boratis	gr. x (0.6)
Aquæ destillatæ	f℥iij (90.0).—M.

It is well to use a solution of antipyrine 2 to 4 grains to 1 ounce (0.12–0.25 to 30.0) of water as spray to prolong the effect of the cocaine. Under no circumstances should the antipyrine be used without the cocaine preceding it, as the pain is too severe.

The parts being thoroughly cleansed, a fine spray of the following should be used as antiseptic, sedative, anesthetic, and protective:

℞—Mentholis	gr. viij (0.5)
Camphoræ	gr. v (0.3)
Petrolati liquidi	f℥j (30.0).—M.

In this prescription the menthol exerts an anesthetic effect, and prolongs the constriction of the parts produced by the cocaine, so avoiding the secondary capillary dilatation due to that drug. The camphor exercises its well-known soothing influence, and the albolene protects the membrane from dust and irritants.

Another plan is the cleanse the mucous membrane, as described, and then to drop into the nostrils 5 to 10 drops of a 1 to 5000 solution of metaphen every two or three hours. An excellent spray is one made up of hexylresorcinol S. T. 37 in the proportion of 1 to 2 or 3 of water. (See Part II.)

The internal treatment consists, in the very beginning of the attack, of the use of the formula for this purpose composed of belladonna, camphor, and quinine, and recommended in the article on Camphor. Much benefit often follows the use of 30-grain doses (2.0) of sodium bicarbonate every two hours for three doses. A hot foot-bath, with mustard in it, and the taking of a hot drink, such as lemonade with whisky in it, on going to bed, are useful. Often 20 to 30 minims (1.3–2.0) of sweet spirit of nitre added to this drink will increase its diaphoretic effect.

This line of treatment is of little value after secretion has been fairly established, and in its place supportive measures are indicated. Small tonic doses of quinine, 2 to 4 grains (0.12–0.25) three times daily, sometimes combined with the use of 5 to 10 grains (0.3–0.6) of chloride of ammonium, as prescribed in the article on Bronchitis, are useful. Where much headache is present full doses of the bromide of potassium or sodium are to be given, and the spray treatment already named for the purpose of cleansing the nasal chambers is to be persisted in while the attack lasts, but the cocaine ought not to be employed at this time unless absolutely needed. (See Camphor.)

CROUP.

(See Diphtheria.)

CROUP (SPASMODIC).

As this is a spasm of the glottis depending for its causation upon irritation of the mucous membrane of the larynx, and as it is due most commonly to some reflex irritation, such as dentition, indigestible food, or sudden atmospheric changes, or to rachitis, or to the presence of postnasal adenoids, the treatment is both prophylactic and curative. Prophylaxis consists in the avoidance of cold; the use of a simple diet, particularly at the evening meal; the rendering of the air of the bedroom moist by means of steam, or at least by the avoidance of dust-laden, furnace-heated air, and by the removal of adenoids and enlarged tonsils, which make the child a "mouth-breather." Irradiated ergosterol is useful if the child is anemic and rachitic. (See Vitamines.) Much relief can be provided such patients by having them sleep in a "bronchitis tent." (See article on Bronchitis.) Small doses of the bromides, chloral, belladonna, or opium may be resorted to at bedtime. A very useful prescription for this purpose is that which follows:

℞—Sodii bromidi . . . . ʒj (4.0)
Syrupi lactucarii . . . . f℥ij (60.0).—M.
S.—Teaspoonful to a dessertspoonful (4.0–8.0) on going to bed, and once or twice during the night if needed.

When the attack is present, a cold cloth should be wrapped about the neck and the child placed at once in a hot bath, the air of the room being moistened by the steam escaping from a kettle of boiling water or by pouring water upon unslaked lime. It is also useful to disseminate the fumes of menthol through the air of the room by heating some crystals in a dry spoon. If the fumes are strong enough to produce a distinct odor, they are present in sufficient amount. If the paroxysm is very severe, a few whiffs of amyl nitrite may be employed.

CYSTITIS (ACUTE).

If, by reason of exposure to cold, injury, the introduction of foreign bodies, such as dirty catheters, or the presence of gonorrhea or other disease due to an infection, an acute inflammation of the bladder ensues, it is accompanied by a sensation of weight and vesical fulness, by pain, tenesmus, and inability to retain the urine. Sometimes the last-named condition may be reversed and retention of urine be present.

If the general system responds to the local inflammation, as evidenced by increased arterial excitement and fever, aconite, in full doses of the tincture, should be used, and it should be combined with small amounts of sweet spirit of nitre and citrate of potassium, as follows:

℞—Tincturæ aconiti		fʒiij (12.0)
Spiritus ætheris nitrosi		f℥j (30.0)
Liquoris potassii citratis	q. s. ad	f℥vj (180.0).—M.

S.—Dessertspoonful (8.0) every four hours until all fever ceases and the pulse is quiet.

At the same time a hot compress should be applied over the bladder, but it should not contain turpentine or any irritant substance which may be absorbed from the skin and when eliminated by the kidneys irritate the bladder-walls. Leeches may be placed upon the perineum or cups applied to the region of the sacrum. In some cases belladonna may be used with or without aconite in the dose of 15 to 20 minims (1.0–1.3) of the tincture three times a day, and it is worthy of note that this drug is particularly serviceable in cystitis due to cold. If the urine is acid and irritating, 5 minims of potassium hydroxide every four hours, or the citrate or acetate of potassium, may be used. If there is much pain and bearing-down, an enema of 30 minims (2.0) of tincture of deodorized opium in 2 ounces (60.0) of starch-water may be employed, or the opium may be given in suppository.

Sometimes a belladonna suppository is of more service, and an iodoform suppository will often relieve the pain by its local anesthetic effects. Hot enemata, without any drugs, are often valuable as a means of relief, and a hot sitz-bath is very efficacious. Cannabis, if an active preparation can be had, may be better than opium in some cases to relieve the pain, since it seems to affect the bladder favorably. The other curative measures are hygienic, and consist in maintenance of the recumbent posture, absolute physical and mental rest, avoidance of all foods which are stimulating, as highly seasoned dishes, and abstinence from all varieties of alcoholic beverages.

Should the inflammation be severe enough to become purulent, the physician should order phenyl salicylate in the dose of 10 grains (0.6) three times a day. This drug, being broken up in the bowel into phenol and salicylic acid, is so eliminated that it renders the urine antiseptic; or in other instances, if the urine is alkaline and phosphatic, hexamethylenamine (urotropin or uritone) in the dose of 5 to 10 grains (0.3–0.6) should be given in capsule after food or drink three or four times a day. (See Hexylresorcinol.) A 10 per cent solution of silvol or argyrol may be used to wash the bladder daily.

Laxatives are to be employed with persistence if the bowels are confined, and saline purgatives in the early stages are generally better than vegetable purges.

Quinine should not be used against the fever, as it is contraindicated, owing to its irritant effects upon the bladder.

CYSTITIS (CHRONIC).

Given a case of chronic cystitis it must be borne in mind that a pathogenic microörganism is usually the cause, or at least is responsible for the continuance of the condition. The urine should be examined bacteriologically and if a specific organism is found in pure or even in dominant numbers, an autogenous vaccine should be given, or, if this is not possible, a stock vaccine should be used. (See Vaccines.) If the colon bacillus is present the urine should be rendered acid by the use of acid sodium phosphate (which see) and methenamine given freely. In other infections alkaline diuretics are usually better. Obstinate cases which do not yield to treatment should be examined by means of the cystoscope and treated locally, as when the trouble is due to a tuberculous ulcer or to a growth. The prostate should also be examined to determine if it interferes with proper emptying of the bladder and urethral stricture is to be sought for. (See Hexylresorcinol.)

The drug treatment of chronic cystitis consists in the use of remedies which will stimulate the diseased mucous membrane, cause a normal secretion of mucus, and so influence the urine that the mucus already formed will be passed out and the fluid rendered alkaline or acid as, may be desired. When the secretion of mucus in large amount is persistent, the urine should be rendered alkaline by the use of potassium hydroxide or the citrate of potassium. The bitartrate of potassium, unlike the other vegetable salts of potassium, such as the acetate or bicarbonate, is eliminated as the bitartrate of potassium, and, as it is acid, cannot be employed.

We acidify the urine when it is necessary to dissolve the phosphates and to prevent deposits in the bladder. The three good drugs for this purpose are methenamine (urotropin or uritone) in the dose of 10 grains (0.65) three or four times a day, acid sodium phosphate in the dose of 20 to 40 grains (1.3-2.6), or benzoate of ammonium 10 to 20 grains (0.6–1.3) three times a day. The rule may be laid down that if the urine is high-colored and is strongly acid, alkalies are useful; whereas if it is light in color, but loaded with phosphates, methenamine should be employed. Methenamine may be given to prevent decomposition of the bladder contents, and if so acid sodium phosphate should also be used.

The remaining remedies which are employed internally in chronic cystitis are those which are directed to the improvement of the mucous membrane of the bladder, and consists of buchu in the form of the fluidextract in the dose of $\frac{1}{2}$ to 1 dram (2.0–4.0), well diluted; arbutin or ursin, 3 to 5 grains (0.2–0.3); or the fluidextract of uva ursi, dose 30 minims to 1 dram (2.0–4.0). All of these are better fitted for the treatment of subacute than chronic cystitis, as they are not sufficiently active for the chronic forms.

In cystitis of a very chronic type, with great vesical atony, strychnine is of service, and drop-doses of tincture of cantharides do great good. Turpentine may also be used with advantage in 5- to 20-minim (0.3–1.3) doses, as may also the oils of eucalyptus, sandalwood, cubebs, and copaiba.

One of the best measures for the relief of chronic cystitis is to irrigate the bladder daily with warm normal saline or water containing bichloride of mercury in the proportion of 1 to 10,000, as this washes away pus and mucus, and prevents irritation. Solutions of nitrate of silver have been used with great success where the urine is mucopurulent, and Thompson recommended the use of a solution of the strength of 1 grain to 4 ounces (0.06–120.0) of water, gradually increased to 2 grains to 1 ounce (0.12 to 30.0). Others, such as Gardner, Richardson, and Potter, recommend the use of stronger solutions, 5 grains to 1 ounce (0.30 to 30.0) of water, claiming that while these amounts may produce serious effects in some instances, they are very efficacious in obstinate cases. The physician should have at hand a solution of common salt, which he should inject into the bladder at once if the effect of the silver solution is too painful or seems excessive. This treatment is suited only to the most chronic cases.

A weak solution of metaphen or a saturated aqueous solution of chloretone may also be used with advantage.

All these measures are suitable for the treatment of cystitis in the male and female, but it is to be noted that injections into the female bladder are made much more readily than into that of the male, because of the shortness of the female urethra. In either case the operation is best performed by attaching a small funnel to a soft-rubber catheter and filling the bladder by raising the funnel when full of water above the patient's belly.

Chronic cystitis in women is often associated with some displacement of the base of the bladder as from a cystocele or pelvic tumor so that remedies fail until the mechanical factors are removed. In chronic cases in women solitary ulcers in the mucosa of the fundus of the bladder as described by Hunner are often responsible for the symptoms and require direct treatment through a cystoscope. Chronic lesions of the female bladder are more frequent in the trigonal area and not uncommonly associated with narrowing of the urethra, both of which are much improved by local treatment. In all cases of chronic irritability of the bladder, tuberculosis of the kidney may be suspected and the patient subjected to such examinations as are necessary to rule out such a lesion.

DIABETES INSIPIDUS.

Diabetes insipidus is a chronic profuse urinary flow dependent upon some disorder of the innervation of the kidney or upon disease of the pituitary body. In most cases, however it depends upon a disordered action of the pituitary body.

The best results follow the hypodermic use of pituitrin. In some instances I have gotten excellent results by using the pituitrin, in a fine spray from an atomizer, sent into the nasal spaces. Langdon highly commends the use of full doses of valerian. How the latter acts is not known.

DIABETES MELLITUS.

The mere presence of sugar in the urine, or glycosuria, does not justify a diagnosis of diabetes mellitus, but if sugar is constantly present the patient is already diabetic or rapidly approaching that state. A normal person, by inordinate ingestion of sugar or starch, may become a glycosuric, and such patients can be made sugar-free by proper regulation of the diet. In diabetes he gradually develops into a state in which he can utilize less and less carbohydrate. After starch is ingested and digested it is absorbed, but the body lacks a factor by which the sugar may be altered so that it can be stored and used. The sugar, therefore, accumulates in the blood and the kidneys at once proceed to get rid of some of the excess in that fluid. This results in polyuria, whereby the tissues are robbed of fluid, are hungry because they are robbed of food, and not only carbohydrate food but protein and fat, for the body proceeds to make sugar out of its protein and cannot oxidize its fat properly. The imperfect combustion of its fats results in the production of toxic substances, which in time produce that state unhappily called acidosis. Some carbohydrate is essential to the oxidation of the fats, and if lacking they are not properly metabolized. It has been well said that the fats burn in the fire of the carbohydrates.

It is also to be recalled that in some instances in which there may be so little polyuria that the possibility of diabetes is not thought of, and the urine is sugar-free, the patient nevertheless may suffer from a severe diabetes with hyperglycemia, because the renal threshold has been raised. So, too, in so-called renal glycosuria, which occurs when the renal threshold is lowered, there may be no diabetes and an actual hypoglycemia. (See below.)

In diabetes the body does not utilize its glucose as it should, largely because the islands of Langerhans are incompetent, resulting in an absence of that substance which makes such utilization possible. It is manifest, therefore, that as there is a lack of such a substance the patient must as nearly as possible ingest a diet which will not require the ordinary amount of his own insulin (see Insulin, Part II) per day and, further, that by keeping carbohydrates at the lowest possible level consistent with existence, that the islands, still capable of functioning somewhat, shall not have too great a demand made upon them, as they need protection and rest. Further, it has been found that by such rest and protection from strain the pancreas may gradually increase its efficiency so that in the end the amount of starch ingested may be very greatly increased without sugar appearing in the urine or an excess of it in the blood. All these facts emphasize the additional fact that the *treatment of diabetes is dietetic first, last and all the time.* There are many cases that are held in check, and perhaps cured, by diet alone. Not only is it essential to rest the islands of Langerhans, but it is usually best to rest the body and mind, because without rest energy is expended, and if energy is expended it is obvious that more food is needed. This is an important matter often overlooked.

The point of prime importance is to determine the carbohydrate tolerance of the patient. The carbohydrate intake, in theory at least, should be that amount which the patient can utilize without developing sugar in the urine or an excess of sugar in the blood. This may be determined by gradually cutting down his food in all its forms or by the institution of one or more starvation days, there being a double reason for so doing, namely, to force him to use the sugar he already has and to rest the islands of Langerhans, which, by such rest, may be able to produce the utilizing substance insulin.

Under some circumstances these methods must be followed not at all or with great caution. Thus, if the patient is known to be passing about as much or more sugar than he is ingesting he manifestly can have little left, and if any considerable quantity of carbohydrate is so lost ketone bodies are developed through incomplete combustion of fat. If, on the other hand, his output is much less than the intake the starvation plan is much safer.

If there is the odor of acetone on the breath, and if acetone and diacetic acid are in the urine, particularly the latter, a very low carbohydrate intake has to be, at least temporarily, avoided, and it is usually best to use levulose or orange-juice or, not so good, dextrose, also using insulin as well. The resort to insulin, enables the body not only to utilize more sugar taken as food, but to employ as well the sugar already in the body and thereby oxidize the fats.

Unless coma is threatened, my belief is that, as a rule, the physician should determine the sugar loss, and if possible the blood sugar, for several days before starting dietetic measures, unless the patient is an excessive eater of all or of one particular type of food. By this means the physician gets a general line on what the patient usually does as to sugar loss and blood sugar. If the contraindications just named are not present he can now institute a low carbohydrate diet, the quantity of carbohydrate usually given being about one-half the amount taken in health or about 200 grams. The next day it is reduced to 100 grams and if not sugar-free, the third day to 50 or 60 grams and the fourth day to about 30 grams. Very often this last will make the patient sugar-free.

Along with this decrease in carbohydrate his intake of protein is reduced about two-thirds, or to 50 grams, and the fats to 50 grams. This is done to force the patient to use his stored glucose if possible, and in the case of the protein, because he can change one-half his protein intake to sugar,[1] and, therefore, his islands of Langerhans are called upon to enable him to utilize it and their rest is destroyed. So, too, protein, by activating metabolism, increases the demand of the body for the sugar which it is unable to employ. It is to be borne in mind, however, that some protein is essential, and after the first few days, or even at the start, it should average 1 gram for each kilo of body weight, that is 16 grains to each 2.2 pounds. In children the proportion should be a little more.

The patient having become sugar-free, the carbohydrates are gradually increased day by day, and the fats can be given comparatively freely, as much as twice or three times the amount of carbohydrate that can be taken without sugar in the urine, but the protein is kept for some time at 1 gram to the kilo and then gradually raised. The carbohydrate is also kept at about 100 grams per day.

While the plan which has just been described may be followed if the case seems to be a mild one, it is better in the great majority to deal with the patient on more accurate and rational lines.

In that part of this book which is devoted to diet it is pointed out that an active, healthy, adult of about 150 pounds needs about 3000 to 3500 Calories per day in foodstuffs, and that this last is obtained from about 400 grams of carbohydrate, 125 grams of protein and 125 grams of fat. At complete rest he needs from 1700 to 2000 Calories, depending on his size. Let us suppose he needs 1700 Calories, because we have put him to rest in bed. This could be provided, if he were in health, by about 275 grams of carbohydrate, 65 of protein and 45 of fat. As already stated, in diabetes his difficulty lies in the fact that he can utilize but little carbohydrate. If he can use only 50 grams instead of 275 he will be lacking 900 Calories. At first thought this might be made up by increasing his proteins and fats, but as 58 per cent of protein is potential glucose, increasing his protein increases his calories very imperfectly and, as fat cannot be consumed in the body except in the presence of carbohydrate, it is evident that the fats cannot be increased beyond a certain point without danger of their imperfect combustion for lack of carbohydrate, with the result that ketone bodies which are toxic are produced. The problem, therefore, is to provide the body with enough calories by adding fat and enough carbohydrate to burn up this extra fat ingested, with enough protein to provide energy and compensate for tissue waste. It is generally considered that Woodyatt's formula may be well followed. It is that the fat may be twice the carbohydrate plus one-half the protein, expressed $F = 2\ C + 0.5\ P$, only half the protein being taken because, while 58 per cent of it is potential glucose, the total 58 per cent is probably never used as such.

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[1] The sugar is not derived from glucose in the protein but from its amino-acids.

Let us suppose that the patient can take only 50 grams of carbohydrate a day without sugar in the urine or a hyperglycemia. Out of the 50 grams of carbohydrate he will get 200 Calories.

It is generally considered that he needs about 1 gram of protein per kilo, which for a 140-pound man will be about 65 grams. Out of the 65 grams of protein he will get 260 Calories.

Now to find the fat, use Woodyatt's formula: Fat = 2 carbohydrate + 0.5 protein, and we find that twice 50 = 100 grams, and half of 65 = 32.5 grams, that is the patient is to have 132.5 grams of fat per day. One hundred and thirty-two and a half grams of fat equals, at 9 Calories to the gram, 1202.5 Calories. Fifty grams of carbohydrates at 4 Calories to the gram equals 200 Calories, 65 grams of protein at 4 Calories to the gram equals 260 Calories or a total of 1662.9 Calories, which approximates the 1700 Calories we supposed he could get along on. As it is usually considered that a patient needs from 30 to 32 Calories per kilo of body weight, which would amount, at 30 Calories, to 1950, it will be seen that the total quantities just given do not come to this number and, therefore, it is desirable to increase the fat, if possible, without ketosis, or to give levulose (see Part II) or to use intarvin, see below. (See Diet lists below.)

If the patient is sugar-free and ketone-free as to the urine, and has normal blood sugar, nothing more need be done, but if he is not in this desired state, or is not holding his weight, and strength is insufficient for his daily life, or some infection takes place, insulin enters the field as an aid, since by its use the intake of carbohydrate in vegetable foods and in meats can be advantageously increased. Before insulin is used, however, it is essential that not only the urine sugar for several days shall be known but the blood sugar as well, for it is a dangerous remedy if the blood sugar is low. After insulin is used the blood sugar should also be estimated to determine how much it has influenced this content. There can be no accurate judging of the needed dose without this information, the more so because some persons respond to very small doses, as little as 5 units, and others fail to respond to very large doses, as in one of my patients who received as much as 130 units a day for many days without clearing up his urine sugar or changing his blood sugar. As a rule, the starting dose is 5 units three times a day, one-half hour before food, unless acidosis is threatened, and the dose is gradually increased until diacetic acid and acetone disappear from the urine and the sugar as well, with a gradual return to normal blood sugar of 0.08 to 0.1. The goal sought is the number of calories the patient needs for his purposes without sugar loss in the urine, and so the proportions of protein, carbohydrate and fat are increased gradually as per the formula already given.

In some patients, largely because the renal threshold is raised, there may be little sugar in the urine and yet a marked hyperglycemia is present. The degree of glycosuria does not, therefore, represent the degree to which the body is unable to utilize its glucose. Another point of importance is that while it is usually well to reduce the blood sugar to near normal by the use of insulin in young persons it may prove disastrous to do so in later years of life, particularly if vascular degeneration is present, as it often is, because of the disease itself or other causes of arteriosclerosis. This is particularly true if the patient has anginoid symptoms or if the retinal vessels reveal degenerative vascular changes. On the other hand a very careful use of diet and insulin may benefit those with anginoid symptoms if the blood sugar is not carried too low. To express it differently, in those who have arterial changes in diabetes the hyperglycemia is, perhaps, a compensatory state in order that the heart and other organs may, by reason of the excess of sugar in the blood, be able to maintain a normal degree of nourishment. It is also to be recalled that a thin diabetic is a better risk than a fat one and no attempts should be made to make a patient weigh more than the average weight for a person of his size in health. Too much fat in the diet tends to induce arteriosclerosis.

The method of control may be based upon the recollection that a unit of insulin is capable of metabolizing a little less than 1½ grams of glucose and, therefore, if the patient is passing about 40 grams of glucose a day about 25 units of insulin may be administered in divided doses one-half hour before meals. Many persons will get along on an injection night and morning. There is, however, no standard dose of insulin, and it is to be clearly understood that insulin is an internal secretion and that the dose used, and the length of time it must be employed, depends upon the general state of the patient and the degree to which the islands of Langerhans have been incapacitated or destroyed. In some patients it may not be possible to prevent some glycosuria. In other words, its employment is somewhat like that of thyroid gland in cretinism and myxedema.

When the physician is in doubt as to the dose because he cannot obtain an estimate of the blood sugar, it is best to give 1 unit at the first dose, 2 at the second, 3 at the third, and so on, until the patient is sugar-free and after he remains sugar-free for some days the insulin may be gradually cut down in dose and perhaps finally stopped.

It is not to be forgotten that if insulin is given in amounts in excess of the needs of the body it will induce a hypoglycemia, and this in turn is followed by immediate severe or lethal symptoms characterized by profound prostration and collapse. If a meal is to be missed the preliminary dose of insulin should be omitted.

On the other hand, if the patient is acetonuric and drowsy, or in coma, carbohydrate should be freely given with enough insulin to utilize it (about 1 unit to each 1½ grams), and nearly always the development of any acute infective process necessitates an increase in the insulin and the carbohydrate. (See Insulin, Part II.)

There are some diabetics whose diet list will show fair amounts of calories, but whose actual ingestion of food has been so small because of poor appetite, that they have been on starvation diet possibly for weeks. These patients may do best if they are allowed to come up as to vigor by the use of easily assimilated carbohydrate food guarded by insulin before an actual course of treatment is instituted.

When the physician meets with a case in which, after the carbohydrate is cut to the quantities already indicated, sugar still persists in the blood in excess in spite of full doses of insulin he has until lately been in a difficult position, because if he cuts the starches still lower he will almost certainly find ketone bodies are forming because the fats are not properly burned. Recently a new form of fat has been introduced, called "intarvin." From ordinary fats, which contain an even number of carbon atoms, oxybutyric acid may be formed, but intarvin contains an uneven number of carbon atoms, and thus can be burned in the body without the production of the toxic ketones. This fat, which when cold appears in granular form, is not disagreeable to take, melts at 38° C. (100° F.) and is given in the same quantities as ordinary fat, namely from 120 to 150 grams per day, which will add 968 to 1200 Calories a day to the diet for each gram of intarvin equals 8 Calories. Intarvin may be obtained in a chocolate emulsion if the patient objects to its taste in its plain form.

In this connection the value of alcohol is to be considered. It will be recalled that alcohol is burnt up in the body and yields energy for it affords 7 Calories to the gram whereas starch yields 4 and fat 9. It does this without being converted into glucose, nor does it give rise to ketone bodies. It can be added to the diet list in moderate amounts, but it cannot take the place of other food to any extent and if taken too freely may, being easily burnt up, interfere with the proper combustion of ordinary foodstuffs. I have found it particularly useful in those advanced in years and in middle-aged persons, who, by taking it with their food, overcome the difficulty they experience in ingesting materials of which they have tired or to which they have a natural distaste. One-half to 1 ounce of good whisky at lunch and supper is usually all that is wise.

It is well to remember that most patients can take one kind of starch at a time better than several kinds, and that oatmeal, potato and rice are the best forms as a rule.

The following diet lists may be resorted to, modified to suit each patient.

DIET LIST NO. 1.—PATIENT'S WEIGHT, 140 POUNDS.

	Calories.	Protein, grams.	Fat, grams.	Carbohydrate, grams.
Breakfast.				
1 cup coffee with 2 tablespoonfuls of 20 per cent cream and saccharine	60	1.0	6.0	1.0
2 eggs	140	12.0	10.0	
2 slices bacon 6 x ½	174	5.0	16.0	
2 tablespoonfuls oatmeal with 2 tablespoonfuls 20 per cent cream	160	3.0	6.0	18.0
1 slice bread 3 x 3½ x ½	60	2.0	0.5	13.0
2 balls butter (20 grams)	160	0.0	17.0	
	754	23.0	55.5	32.0
Dinner.				
Tea or coffee with 2 tablespoonfuls 20 per cent cream and saccharine	60	1.0	6.0	1.0
6 raw oysters	48	6.0	1.0	3.0
Meat, 1 fair slice	140	14.0	9.0	
Bread, 3 x 3½ x ½	60	2.0	0.5	13.0
Cream cheese, 2 inches square	65	4.0	5.0	0.5
2 balls butter (20 grams)	160	0.0	17.0	
Lettuce with vinegar and 2 tablespoonfuls of olive oil	280	0.0	32.0	
	813	27.0	70.5	17.5
Supper.				
Milk, 1 glass (8 ounces)	160	8.0	10.0	12.0
2 eggs	140	14.0	10.0	
1 slice bread	60	2.0	0.5	13.0
4 olives	60	0.0	5.0	2.0
Whisky, 1 ounce	about 100	0.0	0.0	
	520	24.0	25.5	27.0
Total	2087	74.0	151.5	76.5

It will be seen that these totals are approximately those already indicated, to wit: Calories, about 2000; protein, about 1 gram per each kilo of weight. If we adhere strictly to Woodyatt's formula we multiply twice the carbohydrate = 154 grams, and half the protein = 38 grams, which would give 192 grams of fat, which is more than this diet list calls for, but as half the protein is changed to sugar, in some cases at least, the additional fat will be burnt up by its aid, or if it is not so burnt and ketone bodies appear some of the fat in this diet may be displaced by intarvin, or, by the use of insulin, more carbohydrate may be utilized and the fat consumed. If insulin is not obtainable and the ketone bodies appear in the urine the fats given in the above table should be greatly cut down, and any attempt to adhere strictly to the Woodyatt formula given up.

A diet list giving approximately the same number of calories with much less fat and twice as much carbohydrate may be used with insulin if ketone bodies are present with the hope that the increased carbohydrate can be utilized by the insulin and the fats thereby so well consumed that ketone bodies will not appear.

DIET LIST NO. 2.

	Calories.	Protein, grams.	Fat, grams.	Carbohydrate, grams.
Breakfast.				
1 cup coffee with 2 tablespoonfuls 20 per cent cream and saccharine	60	1.0	6.0	1.0
2 eggs	140	14.0	10.0	
3 tablespoonfuls oatmeal with 2 tablespoonfuls cream	160	4.0	6.0	21.0
1 slice bread or toast	70	2.5	0.5	13.0
2 balls butter (20 grams)	160	..	16.0	
	590	21.5	38.5	35.0
Dinner.				
Tea and saccharine				
6 oysters	48	6.0	1.0	3.0
Meat (1 fair slice)	140	14.0	9.0	
Bread (1 slice)	70	3.0	0.5	13.0
Potato (1 medium)	90	2.0	2.0	20.0
Butter (2 balls, 20 grams)	160	..	16.0	
	508	25.0	28.5	36.0
Supper.				
Milk (2 glasses)	300	15.0	19.0	24.0
Uneeda Biscuit (3)	90	1.5	1.5	15.0
2 eggs	140	12.0	10.0	
Rice boiled (2 tablespoonfuls)	70	2.0	..	14.0
Whisky (1 ounce)	about 100			
	700	30.5	30.5	53.0
Total	1798	77.5	97.5	124.0

Another diet list which may be alternated with No. 1 follows:

DIET LIST NO. 3.

Breakfast.	Calories.	Protein, grams.	Fat, grams.	Carbohydrate, grams.
1 cup coffee with 2 tablespoonfuls				
40 per cent cream	60[1]	..	12.0	1.0
and levulose 1 teaspoonful	33	..	.	8.0
2 eggs	140	14.0	10.0	
1 slice bread	70	2.5	0.5	13.0
and 2 balls butter (20 grams)	160	..	16.0	
	463	16.5	38.5	22.0
Or 3 tablespoonfuls oatmeal (150 grams) with 2 tablespoonfuls of cream	160	3.0	12.0	18.0

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[1] If ketone bodies appear in the urine, substitute intarvin for cream and butter.

Dinner.	Calories.	Protein, grams.	Fat, grams.	Carbohydrate grams.
Tea with cream (2 tablespoonfuls)	60[1]	..	12.0	1.0
and levulose 1 teaspoonful	10	..	..	8.0
6 oysters	48	6.0	1.0	3.0
Meat, 1 fine slice	80	11.0	9.0	
Asparagus and cream dressing	35	2.0	2.0	3.0
Whisky (1 ounce)	about 100			
	333	19.0	24.0	15.0
Or spinach with cream (100 grams)	25	2.0	2.0	4.0
Or squash (100 grams)	40	1.0	0.5	9.0
Or cauliflower (100 grams)	33	2.0	0.5	5.0
Supper.				
Milk, 2 glasses	160	20.0	19.0	24.0
with 4 ounces cream	480[1]	..	48.0	3.0
1 lamb chop (100 grams)	80	11.0	9.0	
Lettuces, vinegar and oil (2 tablespoonfuls)	296	1.0	32.0	3.0
Beets (100 grams) (or carrots)	37	2.0	0.1	7.0
Whisky (1 ounce)	about 100			
	1153	34.0	108.1	37.0
	463	16.5	38.5	22.0
	318	19.0	24.0	15.0
	1934	69.5	170.6	74.0

Patients vary so much as to taste for various articles that it not infrequently happens that they refuse several of the foods named and so while served with sufficient calories do not ingest the total number ordered by the physician. They nearly always will ask for bread to take the place of any other food. It is often possible to permit this, giving 1 slice three times a day, equaling 210 Calories composed of protein 7 grams, fat 1.5 grams and carbohydrate 39 grams. It is well to give 1 gram of protein to each kilo of body weight.

It is not possible in this book to give food values *in extenso*. Reference must be made to books on diet for these figures. The following list may nevertheless prove useful.

Hill and Eckman give these portions as equalling about 100 grams.

Asparagus—8 or 9 stalks 4 inches long.
Beans (string) (cut in small pieces)—2 heaping tablespoonfuls.
Bacon—4 slices 6 inches long, 2 inches wide.
Cabbage (cooked)—2 heaping tablespoonfuls.
Cauliflower—2 rounding tablespoonfuls.
Celery—6 pieces 4½ inches long, medium thickness.
Cheese—1 piece 4 inches by 1½ inches by 1 inch.
Cucumbers—12 slices ⅛ inch thick, 1½ inches in diameter.
Greens (spinach, kale, etc.)—2 heaping tablespoonfuls.
Lettuce—10 to 12 medium-sized leaves.
Olives—25 small olives.
Onions—2 onions size of an egg.
Peas—2 heaping tablespoonfuls.
Potatoes (baked)—1 small potato, size of an egg.
Potatoes (mashed)—2 rounding tablespoonfuls.
Sardines—28 sardines = 1 small box.
Tomatoes—2 heaping tablespoonfuls.
Tomatoes (fresh) — 1 medium-sized tomato, 2 inches in diameter.

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[1] If ketone bodies appear in the urine, substitute intarvin for cream and butter.

The following proportions are based on Atwater and Bryant's *Bulletin No.* 28, U. S. Department of Agriculture.

		Protein.	Fat.	Carbohydrate.	Calories
Beef	100 gm.	22.0	28.0	..	350
Chicken	"	32.0	4.0	..	168
Oysters	"	6.0	1.0	3	46
Eggs (1)	"	7.0	6.0	..	84
Butter	"	1.0	85.0	..	795
Cheese (American)	"	28.0	35.0	2	448
Cheese (Neufchâtel)	"	19.0	27.0	2	337
Milk (whole)	"	3.0	4.0	5	70
Oatmeal (cooked)	"	3.0	0.5	12	66
Rice (cooked)	"	3.0	0.1	24	112
Macaroni (cooked)	"	3.0	0.1	24	112
Bread	"	9.0	1.0	53	264
Soda Crackers	"	10.0	9.0	73	424
Asparagus (canned)	"	2.0	1.0	3	30
Beans (string) fresh cooked	"	1.0	1.0	2	22
Beets (cooked)	"	2.0	0.1	7	37
Cabbage (raw)	"	2.0	0.3	6	35
Carrots (raw)	"	1.0	0.4	9	45
Cauliflower (raw)	"	2.0	0.5	5	33
Celery (raw)	"	1.0	0.1	3	17
Corn (green)	"	3.0	1.0	20	103
Cucumbers (raw)	"	0.8	0.2	3	17
Lettuce (raw)	"	1.0	0.3	3	19
Mushrooms (raw)	"	3.0	0.4	7	45
Onions (raw)	"	1.0	0.3	10	48
Spinach	"	2.0	0.3	3	23
Squash	"	1.0	0.5	9	46
Tomatoes	"	0.9	0.4	4	24
Turnips	"	1.0	0.2	8	39
Oranges (edible portion)	"	0.8	0.2	11	50
Strawberries	"	1.0	0.6	7	38
Grape fruit as purchased (1 small)	300 gm.	2.0	..	30	131

Diabetic intoxication is the chief danger to be feared by the physician and patient. It is due chiefly to the fact that the loss of carbohydrate from the tissues results in the faulty combustion of the fats with the result that ketone bodies, β-oxybutyric acid, diacetic acid and acetone are produced. In healthy persons oxygen is carried to the tissues where the fat is consumed, and water and carbon dioxide result. This carbon dioxide is carried by the carbonates of the blood, chiefly as sodium bicarbonate, to the lungs, the CO_2 is given off and the carbonate of sodium returns to the tissues. So much of the carbonates is lost when the ketone bodies are formed that the CO_2 is left in the tissues and the oxygen in the blood is not used for normal oxidation processes or for oxidizing the β-oxybutyric acid into diacetic acid and acetone. The loss of carbonates is not due to a chemical combination with these acids, but by a conjugation whereby they are eliminated by the kidneys. In other words, the use of alkalies is not for the purpose of neutralization but for oxidation and elimination of the poisons. There are, therefore, two courses to pursue: (1) To give carbohydrates freely with insulin, so that they may be utilized in consuming the fats completely, and (2) to use bicarbonate of sodium to replace that lost to the body and moderate doses not large enough to induce alkalosis, are probably wise. The first plan is so much the better for obvious reasons that it should be followed, if possible, as follows: (See also Insulin, Part II.)

As soon as evidences of acidosis appear, as shown by the odor of acetone on the breath and mental slowness, some readily utilized form of carbohydrate should be given with insulin. The dose of insulin depends upon the gravity of the case. In coma 20 units may be given every hour until betterment occurs and if the breathing is urgent the dose should be 40 units every hour or every half hour until good results are reached. A rough gauge as to the dose of insulin is as follows: 15 units for a red reaction in the urine with Benedict's solution, 10 units for a yellow reaction and 5 for a green reaction. If levulose can be had, 1 or 2 ounces may be given in twelve to twenty-four hours, or glucose as met with in so-called "corn syrup" may be employed in an emergency. (See Dextrose, Part II and Intravenous Injection, Part III.) As orange-juice contains much levulose, it is an excellent remedy and 3 ounces of it may be given every few hours with insulin, about 20 units for each administration. As 100 grams of carbohydrate per day are usually sufficient in these cases, it is well to recall that orange-juice contains about 10 grams of carbohydrate in each 100 cc. (about 3 ounces), particularly if other sugars are employed. If the symptoms are urgent 10 to 15 minims of adrenalin solution (1 to 1000) are given hypodermically for its effect in setting sugar free in the blood, but repeated doses should not be employed as there is some evidence that large amounts of adrenalin tend to nullify the effects of insulin. Water is essential, and if the stomach does not take it readily 1 quart should be given by hypodermoclysis in the form of salt solution and by the rectum or intravenously but not more than 3 ounces an hour. External heat, provided by wrapping the patient in blankets with several hot-water bags, is essential. As the progress of diabetic acidosis is often fulminant, no timidity in dosage or delay in beginning treatment should be permitted. If the epigastrium is distended use lavage to prevent gastric dilatation. Full doses of caffeine by needle is often valuable particularly if the blood-pressure is low, the eyeballs feel soft, and the temperature is low. After the danger is past the return to the quantities of food and insulin previously used should not be too abrupt. On the other hand, either a too great carbohydrate intake or a too free use of insulin may be harmful if persisted in longer than needful, because however advantageous the carbohydrate may be for the moment, its free use is bad for the real disease, diabetes.

The bicarbonate of sodium may be given in water by the mouth until the urine is alkaline, or if need be by hypodermoclysis or by intravenous injection. The solution must not be boiled to sterilize it, because boiling changes the bicarbonate into the very irritating carbonate. The sodium must not be given to excess or it will induce what may be called alkalosis instead of acidosis. Usually 500 cc. (1 pint) of a 3 per cent solution is sufficient for intravenous use. The continued use of soda is unwise for the object is not to attempt to neutralize acidity which in the ordinary sense does not exist. By the use of dextrose and insulin we oxidize the ketone bodies and so the therapy is direct. The use of sodium bicarbonate should be stopped as soon as the urine becomes faintly alkaline. (See Sodium Bicarbonate, Part II.) It is hardly necessary to add that as the ketone bodies are derived from the fats and somewhat from the proteins, these articles of food should be temporarily stopped, that is, until the crisis is passed.

A useful artificial milk will be found described in Part III.

The treatment of diabetes by drugs is varied by the condition of the patient, the cause of his disease and the quantity of sugar in the urine, but little drug treatment is needed if insulin is used.

Opium or one of its alkaloids, such as morphine or codeine, are often employed to allay the nervous irritation of the patient. The former is used in the dose of $\frac{1}{4}$ to $\frac{1}{2}$ grain (0.015–0.3) three times a day; the latter, 1 to 5 grains (0.06–0.3) three times a day, and the writer has found them very useful. The morphine is by far the more powerful for good, but some patients who are diabetic must take large ascending doses of opiates to get good results. (See article on Opium.)

It is not to be forgotten that in cases of severe diabetes that have been ill for a long time degenerative changes take place in the various organs of the body along with lipemia. Such conditions must be recognized as they materially influence the general course of treatment and the prognosis.

DIARRHEA AND DYSENTERY.[1]

The term diarrhea is applied, perfectly correctly, to all forms of intestinal disturbance accompanied by the passage of liquid stools, and its meaning, "to run through," expresses the state it represents. The treatment of each form of diarrhea depends upon its cause, and no case can be intelligently treated in which the physician fails to recognize this aspect of the case. Diarrhea is but a symptom, not a disease, and must not always be regarded solely as an evidence of intestinal disorder.

While the same drugs are prescribed in many forms of the trouble, we may divide the cases of diarrhea into four classes, as follows: (*a*) Those in which the laxity is due to a catarrh, acute or chronic, of the intestinal mucous membrane, causing the passages to contain mucus; (*b*) those in which, owing to disordered innervation, a profuse outpouring of liquid takes place from the bloodvessels into the intestinal lumen; (*c*) those in which purging is an effort at elimination; (*d*) those in which, owing to disease, the glands fail to prepare juices to digest the food properly; and finally (*e*) those cases in which ulceration causes irritation and bloody purging.

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[1] The articles on Cholera, Cholera Morbus and Cholera Infantum should be carefully read in connection with this article.

The treatment of the catarrhal form first named consists primarily in regulation of the diet, which should be made up chiefly of milk, boiled or predigested, or of milk whey, and in the administration of castor oil or other mild purge, such as sulphate of magnesium, to sweep out fermenting food and mucus. Enough laudanum should accompany this oil to prevent griping, and it is well to add bicarbonate of sodium, grains 20 to 30 (1.3–2.0) to the dose both to aid the action of the oil and to render the bowel alkaline in reaction (normal) instead of acid, as caused by the fermentation abnormally present. A mustard-plaster or other counterirritant should be applied to the abdomen. Often in the milder forms of mucous diarrhea this is all that is needed, but more frequently it must be followed by the use of tonics and astringents, such as chalk mixture or bismuth.

℞—Plumbi acetatis . . . . gr. ij (0.12)
Extracti opii . . . . gr. ij (0.12).—M.
Fiant pilulæ, No. x.
S.—One three times a day.

If these stop the diarrhea, yet there still seems to be a tendency for it to return or atony is present the following may be ordered:

℞—Acidi nitrici diluti . . . . f ʒj (4.0)
Tincturæ cardamomi compositæ . . . . . f ℥ij (60.0)
Tincturæ gentianæ compositæ . . . . . . f ℥ij (60.0).—M.
S.—Dessertspoonful (8.0) every four hours.

In the second form of diarrhea named—that in which serous or watery purging is present—the treatment is radically different. In these cases the bloodvessels of the gut are relaxed and leaking, and must be contracted and made, so to speak, water-tight. This dilatation may result from fear ("nervous diarrhea"), from exposure to cold, or from exhaustion, extreme heat and irritating food. If from irritating foods these are generally swept out in the first flush of liquid, but no remedy should be given to check the diarrhea until all offending food is passed. Often a dose of castor oil is the first and best thing to employ.

The measures to be adopted consist in those directed to the contraction of the dilated and relaxed bloodvessels and the restoration of the proper nerve supply to the parts.

As the splanchnic nerves are the vasomotor nerves of the intestine as well as the inhibitory nerves of peristalsis, it is evident that drugs must be used which will cause stimulation of these fibers, and the chief of these is found to be opium, which diminishes intestinal peristalsis and secretion by just such an influence. In the same way small doses of volatile oils are of service, and camphor and spirit of chloroform may be used. As there is relaxation, astringents are indicated; and as sulphuric acid is not only astringent, but is eliminated by the lower bowel, it is peculiarly serviceable. We find, therefore, that the following prescription fulfils the indication:

℞—Acidi sulphurici aromatici		f℥ss (16.0)
Fluidextracti hæmatoxyli		fʒij (8.0)
Spiritus chloroformi		fʒiv (16.0)
Syrupi zingiberis	q. s. ad	f℥iij (90.0).—M.

S.—Teaspoonful (4.0) in water every two or three hours.

If desired, tincture of kino or gambir may be used in lieu of the fluidextract of hæmatoxylon, or paregoric substituted for the spirit of chloroform.

℞—Acidi sulphurici aromatici	fʒiss (6.0)
Spiritus chloroformi	fʒij (8.0)
Tincturæ opii camphoratæ	f℥ij (60.0)
Syrupi zingiberis	f℥iv (120.0).—M.

S.—Dessertspoonful (8.0) in water every two hours.

Or,

℞—Tincturæ kino		f℥j (30.0)
Tincturæ gambir compositæ		f℥j (30.0)
Misturæ cretæ		f℥iij (90.0)
Aquæ cinnamomi	q. s. ad	f℥vj (180.0).—M.

S.—Shake well before using. Tablespoonful (16.0) every three hours.

In some instances these attacks appear to depend upon hepatic disorder, and the only cure is to be obtained by the use of 2 to 6 grains (0.12–0.4) of mercury with chalk (hydrargyrum cum creta) or calomel given in $\frac{1}{6}$ to $\frac{1}{2}$ grain (0.01–0.03) doses until 1 or 2 grains (0.06–0.12) have been taken. What is said of intestinal disorder from lack of secretion under the heading of Cholera Infantum applies very forcibly to these cases, and diarrhea may persist for weeks, or only temporarily be held in check by the most powerful drugs, until the physician thoroughly flushes the intestine with bile by the use of calomel.

For the purpose of establishing intestinal antisepsis, phenyl salicylate (salol) may be used. In other cases phenolsulphonate of zinc in the dose of from 1 to 4 grains (0.06-0.25) in powder or capsule is beneficial. Phenyl salicylate combined with chalk mixture may also be advantageously used. (See prescriptions under Salol.) It is doubtful if true intestinal antisepsis can be produced by drugs; and if it can, they probably destroy useful benign organisms as well as those which are malignant.

Wood highly recommended the use of 20 grains (1.3) of bismuth powder containing 1 minim or 2 of phenol every three hours.

The regulation of the diet, which should consist in sterilized milk or koumyss, the former being predigested, is of the greatest importance.

The after-treatment consists in the use of tonics and a carefully regulated diet, which should be largely composed of milk and milk foods. When putrefaction is present the lactic acid bacillus is useful.

The third class of cases consists chiefly of children who pass fetid, "mousy" smelling stools in summer diarrhea, with green, spinach-like masses, semi-digested food and which have distinct lientery. These cases are often cured by the use of pepsin and hydrochloric acid to aid in gastric processes. In other instances the duodenum is at fault, and should be stimulated by small doses of nitrohydrochloric acid, or by podophyllin in the dose of $\frac{1}{50}$ to $\frac{1}{40}$ grain (0.0012–0.0015), with a little milk sugar, or given in alcoholic solution. Similarly, ipecac in pill form may be used in the dose of $\frac{1}{4}$ to $\frac{1}{2}$ grain (0.015–0.03) three times a day. In the case of children who are sufferers from rickets, lime salts and common salt should be freely given. (See Cholera Infantum and Vitamines.)

The fourth type, generally known as dysentery, is due in nearly all cases in the temperate zone to the microörganisms of Shiga and Flexner, bacillary dysentery, and to the drinking of impure water, exposure to heat or cold, and the use of improper food. It is in most cases a very obstinate form of diarrhea, requiring much skill and patience for its cure. Usually it is a good plan to start treatment with $\frac{1}{2}$ ounce (15.0) of castor oil to sweep out the bowel. (See Antidysenteric Serum, Part III.) Absolute rest in bed, heat or counterirritation over the belly and a diet of whey or thin boiled rice is to be ordered. Milk, if curds appear in the stools, is forbidden. There are three remedies which are far above all others in value. The first of these is sulphate of magnesium; the second, sulphuric acid; the third, calomel.

In bacillary dysentery ipecac is useless and Flexner's polyvalent vaccine or Shiga's serum may be tried. (See Antidysenteric Serum.)

The magnesium salt should be used in a special manner to be effective. (See Magnesium Sulphate.) If calomel is used, it must be given in full purgative amounts, but is contraindicated if much weakness is present.

In amœbic dysentery there can be no question that emetine exercises a specific effect, both as a cure and to prevent complications if used in acute cases. It is not to be forgotten that the free use of emetine by the needle may induce diarrhea, and this laxity of the bowels may be misinterpreted and result in the continued use of the drug when in reality it should be stopped. (See Ipecacuanha, Yatren and Stovarsol, Part II, Important.)

The important points to be remembered, aside from the use of emetine in amœbic dysentery, are that there is often an associated bacterial infection and that the amœba deeply buried in the floor of the ulcers cannot be reached by colonic injections. The best treatment would seem to be: (1) The intramuscular dose of emetine hydrochloride in the dose of $\frac{1}{2}$ to $\frac{2}{3}$ grain (0.03–0.04) once a day for five or six days and repeated after an interval of a week or less; and (2) the control of excessive purging by full doses of bismuth subcarbonate. If purging is not very excessive the use of magnesium sulphate and aromatic sulphuric acid (see Magnesium Sulphate) may be resorted to as in bacillary dysentery. Colonic lavage with 1 to 1000 of mercurochrome 220 using water at 110° F. is often advantageous, the treatment being given daily. Large rectal injections of a solution of quinine in the proportion of 1 to 3000 may be used, as this drug destroys the amœba. The patient should be kept at rest in bed.

In old cases emetine often fails because the parasite is deeply imbedded in cicatricial tissue and it is in such cases that emetine has to be supplanted by yatren or stovarsol (which see in Part II).

As Vedder has shown that nitrate of silver in so weak a solution as 1 to 300,000 kills the *Entamœba histolytica*, it can be employed for irrigation purposes with advantage, associated with emetine hypodermically. (See Enteroclysis, Part III.) In obstinate chronic cases, even if they are very feeble, appendicostomy may be needful with irrigation of the colon through the opening. When it is thought wise to use emetine by way of the rectum the plan of Willmore may be resorted to. Dissolve 1 grain of emetine alkaloid in 2 drams of olive oil, add 4 drams of ether and 8 ounces more of olive oil, and inject with patient lying on left side after the intestine has been cleansed by a preliminary lavage. This is repeated every second or third day for six to twelve treatments.

If the passages are slimy and bloody, $\frac{1}{200}$ grain (0.0003) of bichloride of mercury every hour or two is of service, and if much blood is present high rectal injections of hamamelis water and water, half and half, are of value. The following mixture may be gently introduced into the bowel in feeble cases:

℞—Sodii boratis	ʒj (4.0)
Tincturæ benzoini	ʒj (4.0)
Spiritus camphoræ	f℥j (30.0)
Aquæ ferventis	Oij (960 cc).—M.

An efficient solution to employ for irrigation where much mucus and pus is present is one of bichloride of mercury, 1 to 5000. When this is used, a pure water injection or one of 1 to 30,000 should follow it, in order to prevent absorption of too much mercury into the system. If for any reason the effect of the bichloride is feared, boric acid may be used in the proportion of 1 dram (4.0) to 1 pint (480 cc.), or 15 grains (1.0) of phenolsulphonate of zinc added to 1 quart (960 cc.) of hot water be injected.

If bleeding is present, or if the ulcers are very old and chronic, nitrate of silver injections, of the strength of 10 to 20 grains (0.6-1.3) to 1 pint (480 cc.) of water, may be employed in large bulk, a salt solution being at hand for the altering of the silver salt if the local action which ensues is too severe.

DIARRHEA (CHRONIC).[1]

This is one of the most obstinate conditions which the physician is called upon to treat. It may be due to nervous irritability of the bowels, so that the entrance of food or drink sets up an excessive peristalsis which so hurries the food and drink through the alimentary canal that digestion and absorption are imperfectly performed. Chronic diarrhea may also be due to chronic intestinal catarrh, to ulcerations of the small or large intestine, as after typhoid fever, or to rectal disease, which reflexly causes hyperperistalsis. Fissure of the anus often causes persistent diarrhea by reflex irritation. In those cases due to hyperperistalsis an advantage is often gained by directing the patient to take as little liquid as possible, particularly at meals, and to avoid coffee or other stimulants to reflex activity. Highly seasoned foods are also to be avoided. Meats should be preferred to vegetables, and an absolute diet of peptonized milk may be ordered, the milk being given in tablespoonfuls every few minutes, rather than in large amounts. The patient should remain in bed. Counterirritation, constant and as severe as the patient can stand, should be used over the abdomen. Suppositories and rectal injections seldom benefit this class of cases, but a pill composed as follows may be useful:

℞—Argenti nitratis	gr. iv (0.25)
Extracti hyoscyami	gr. x vel xxx (0.6–2.0)
Extracti opii	gr. ij vel iv (0.12–0.25).—M.

Fiant pilulæ, No. xx.
S.—One pill one hour before each meal.

This pill or capsule should be coated with phenyl salicylate so that it will pass through the stomach before dissolving.

In other instances some of the astringent prescriptions given under the article on Diarrhea and Dysentery are better than the above.

If the catarrhal state is persistent, no remedy compares to the chloride of ammonium, dose 5 grains (0.3) every four hours in fluidextract of liquorice and water. Where the catarrhal state is exceedingly chronic and obstinate it is well to employ 3- to 5-grain (0.20–0.3) doses of potassium iodide. In many cases where the condition of mucous diarrhea becomes chronic it is necessary to resort to enteroclysis (Part III) and the treatment needed in cases of chronic intestinal catarrh. Not rarely what is called colitis is really sigmoiditis. Persistent pain in the region of the sigmoid or rectum should be treated first by the use of the proctoscope or sigmoidoscope to determine the exact state of the lower bowel. Sometimes ulceration will require local treatment or, by careful examination as indicated, *carcinoma* will be discovered.

In the cases due to ulcers of the rectum injections of nitrate of silver, 2 grains to the ounce (0.12 to 30.0), are of value, particularly if followed by a 5- or 10-grain iodoform suppository. Operative procedure against anal fissure will often cure a diarrhea due to this cause.

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[1] Read with this article those on Diarrhea and Dysentery and Enteroclysis.

In cases of so-called morning diarrhea abstinence from liquids before going to bed the night before and a very dry and small breakfast are to be strongly recommended, with rest in bed during the morning hours.

Dried sulphate of iron in pill is useful in cases of diarrhea with anemia.

DIPHTHERIA AND MEMBRANOUS CROUP.

While it is a fact that in some cases of membranous pharyngitis or laryngitis the true Klebs-Loeffler bacillus cannot be found, it is also a fact that all cases should be treated as if they are true diphtheria, since in this way much good can be done, and no harm follows if true diphtheria fails to develop. Diphtheria is at first a distinctly local disease, the membrane in the upper air-passages forming a nidus from which the entire body ultimately becomes poisoned by the toxins of the microörganism peculiar to the malady.

The best local application to the throat is peroxide of hydrogen. A cotton swab should be soaked with the undiluted 10- or 15-volume solution and pressed against the mucous membrane which is diseased; or, if this cannot be done, a spray, from a glass atomizer, of the strength of 1 to 4 of water may be employed. The effect is often extraordinary. After a few applications the false membrane appears to exist only in disorganized shreds.

The local use of iodine, phenol, and similar irritating and poisonous substances is not justifiable.

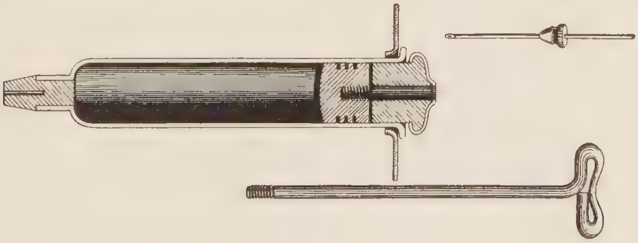


Fig. 119.—Pass the piston rod through the opening in the cork and screw it firmly into the bushing in the rubber plunger, rotating the latter to break up any adhesions which have formed between the rubber and the glass. The plunger must rotate freely. If adhesions do not break away, the guide cork may be slipped out and back on the piston, and the plunger loosened by rocking the piston from side to side.

The blunt (exposed) end of the double-pointed needle should be thrust through the rubber plug of the syringe.

Then remove the wire from the needle and expel the air from the syringe.

Antitoxin Treatment.—This method excels all others in efficacy and usefulness, and should displace all other plans of treatment except the local applications. Of all the extraordinary advances made in pathology and therapeutics, the introduction and proof of the value of antitoxin in cases of diphtheria is perhaps most worthy of note. (For the study of Antitoxin itself, see Antitoxin, in Part III.)

At the present time all manufacturers of antitoxin put up their product in hermetically sealed bulbs, or in special containers from which the serum may be directly injected without the use of an extra syringe. The advantage of this plan is that the physician is saved the trouble of sterilizing a syringe and can use a fresh piece of apparatus for each injection (Fig. 119).

The dose of antitoxin serum is to be judged by its known strength or power of conferring immunity and *by the severity of the disease and the susceptibility of the patient to the infection.*

The following dose table is based upon the authority of the Department of Health, City of New York (*Bulletin*, June 3, 1916):

THERAPEUTIC DOSES IN UNITS.

Nature of case.	Infants (under 2 years) 10 to 30 pounds in weight.	Children (under 15 years) 30 to 90 pounds in weight.	Adults, 90 pounds and over in weight.
Mild	2,000 to 3,000	3,000 to 4,000	3,000 to 5,000
Moderate	3,000 to 5,000	4,000 to 10,000	5,000 to 10,000
Severe	5,000 to 10,000	10,000 to 15,000	10,000 to 20,000
Malignant . . .	10,000 to 15,000	15,000 to 20,000	20,000 to 40,000

Cases of laryngeal diphtheria, moderate cases seen late at the time of the first injection, and cases of diphtheria occurring as a complication of the exanthemata should be classified and treated as "severe" cases. In all cases a single large dose of the proper amount, as indicated in the schedule, is recommended, because the antitoxin remains in the blood for several days. Repeated doses do no harm but little good if the first one is adequate, but if the patient has been sensitized by previous doses, divided doses are safer. (See Anaphylaxis under Antitoxin, Part III). Park states that when antitoxin is given hypodermically it takes two days to get its full effect, whereas the intravenous dose is effective at once. In all severe cases, therefore, if not used intravenously the injection should be into a muscle not hypodermically. It is to be recalled, however, that if a dose has been given on another occasion, or the patient is naturally sensitized, the intravenous injection is more dangerous so far as anaphylaxis is concerned. (See below.)

When given intravenously the serum must be clear and warm and injected not faster than 1 cc. to the minute, into a vein of the arm as a rule. As it is difficult to enter a vein in a puny child, the antitoxin in severe cases should be given by abdominal puncture. (See Intra-abdominal Injection, Part III.) In extremely toxic cases 15 to 25 cc. of spinal fluid should be removed by puncture and replaced by an equal amount of antitoxic serum.

It has been urged against serums containing over 250 units per cubic centimeter that their use is apt to be followed by untoward effects, such as skin eruptions and local irritations. On the other hand, if the weaker serums are employed, such large amounts have to be given that very considerable swelling of the area in which the injection is given is produced, and, of course, valuable time is lost before the whole dose is absorbed; whereas if serums containing high immunizing power are employed, the small dose is quickly absorbed. In urgent cases of nasal or laryngeal diphtheria the stronger serums are indicated, whereas in the more moderate cases the lower grades of strength may be used.

The author cannot too strongly urge upon the reader the vital importance of using antitoxic serum early and freely. It has been claimed by some persons that since the use of antitoxin more cases of complications or sequelæ are met with than ever before. The reason is manifest, viz., that before antitoxin was used all the very malignant cases died, whereas a large percentage of these are now saved, and suffer from lesions which if antitoxin had not been used would have been fatal. Every patient who apparently suffers from the disease should receive this remedy, so potent for good and so lacking in harmful qualities even when given to non-diphtheritic persons. The physician who can obtain the serum and does not use it is remiss in his duties.

Much depends upon the early use of the remedy, for after degenerative changes have taken place in the heart and kidneys the damage is done. Statistics show that in cases which receive the antitoxin on the first day the mortality is often only 3 to 5 per cent, whereas with each day of delay the percentage rises, so that when it is not given until the fourth day the mortality may be as high as 40 per cent. As the use of antitoxin does no harm, it should be employed in all doubtful cases of diphtheria without waiting for a bacteriological diagnosis.

When the antitoxin is given, general improvement usually takes place in twelve to thirty-six hours, and the temperature falls. The spread of the membrane is arrested and its separation soon begins. (For serum sickness and anaphylaxis see Antitoxin, Part III.)

Having considered the use of antitoxin for the cure of diphtheria, it is now necessary to discuss its use for the purpose of protecting children and adults who have been exposed to infection. If the exposure has been direct, from 500 to 1000 units should be used at once, particularly if the child is between three and six years, to produce immunity. If there has been no direct exposure it is wise to use the Schick test to determine whether the individual is naturally immune (see below). If this test is positive, toxin-antitoxin (see below) should be given to establish artificial immunity. As a means of protecting large number of children in cities, schools and asylums, the Schick test and toxin-antitoxin should be employed even when no sporadic or epidemic outbreak of the disease is present, just as we employ vaccination to protect from smallpox.

The age of the patient is to be considered in determining the danger of the disease developing. Thus, between six months and three years of age the susceptibility varies from 60 to 70 per cent, after fifteen years 20 per cent and after twenty years only 12 per cent.

The so-called Schick test consists in injecting *into the skin* of the flexor surface of the forearm, not under it, about $\frac{1}{50}$ part of the so-called minimum lethal dose of diphtheria toxin for a 250-gram guinea-pig. This is diluted before injection, with 3 minims (0.2) of salt solution. It is of great importance that the test be properly employed. The skin of both forearms or the flexor surface should be cleaned by the use of alcohol. After drawing up the toxin insert the needle intradermally, not hypodermically, with its eye up so that this orifice can be seen through the superficial skin. The fluid is then injected so gently that the skin is not ruptured. A similar procedure is carried out on the other arm, except that by first exposing the toxin to 75° C. (167° F.) for not less than five minutes, the toxin is destroyed. This heating, however, does not destroy the protein in the fluid which may cause a pseudo-reaction. (See Plates V and VI, prepared by the Department of Health of the City of Philadelphia.) When the physician is experienced in recognizing a true reaction this control test is not essential. If the patient's blood contains $\frac{1}{10}$ of a unit of antitoxin in each cubic centimeter, the child is immune and little effect is produced, but if it needs antitoxin to artificially protect it a reddened and tumified area develops in from twenty-four to seventy-two hours and lasts from seven to ten days, and then becomes brownish and scaly and desquamates in ten days to two weeks. (See Plates V and VI.) A pseudo-reaction appears within a few hours and consists in greater infiltration, is less sharply outlined and disappears in twenty-four to forty-eight hours or is seen to be rapidly disappearing at this time (see Plates V and VI), whereas the positive reaction is now at its maximum. It does not scale. The method is perfectly safe and the toxin ready for the test can be obtained on the market in capillary tubes of toxin with a tube of salt solution.

Toxin-antitoxin.—Toxin-antitoxin consists of diphtheria toxin (80 per cent of the L+ dose) neutralized by 1 unit of antitoxin. It is designed to induce artificial immunity but in the presence of an epidemic, if as long as six months have elapsed since toxin-antitoxin has been used, the child should have another Schick test and if it is positive antitoxin be given if exposed, or if not directly exposed toxin-antitoxin. If it is properly prepared it is entirely safe although occasionally a local swelling develops which has no evil significance. Thus Park and Zingher report 50,000 injections in the space of four months without a single serious reaction and without a single infection. The immunity conferred by antitoxin lasts about three to four weeks, whereas that induced by toxin-antitoxin lasts about three to

PLATE V

FIG. 1

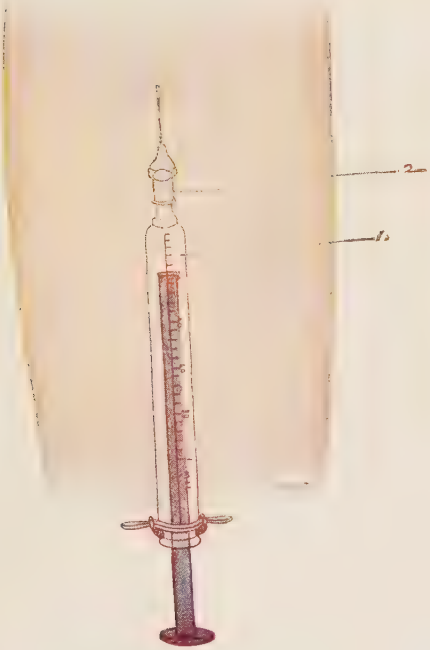


FIG. 2

Fig. 1.—Needle and syringe in position to deliver dose for Schick test.

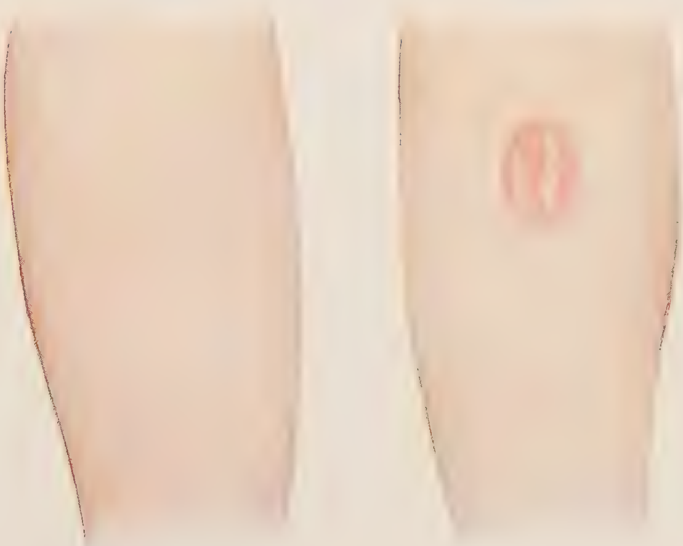
Note the eye of the needle turned upward in the superficial layer of the skin, also note gradations on syringe turned upward.

Point one—the size of the dose.

Point two—grasp the joint of syringe and needle when delivering dose so as to prevent leakage; considerable resistance will be met when the dose is discharged.

Fig. 2.—A raised wheal will mark the site of injection immediately upon discharging the dose for the Schick test—it appears in every case; note pitting of hair follicles.

FIG. 3



Right

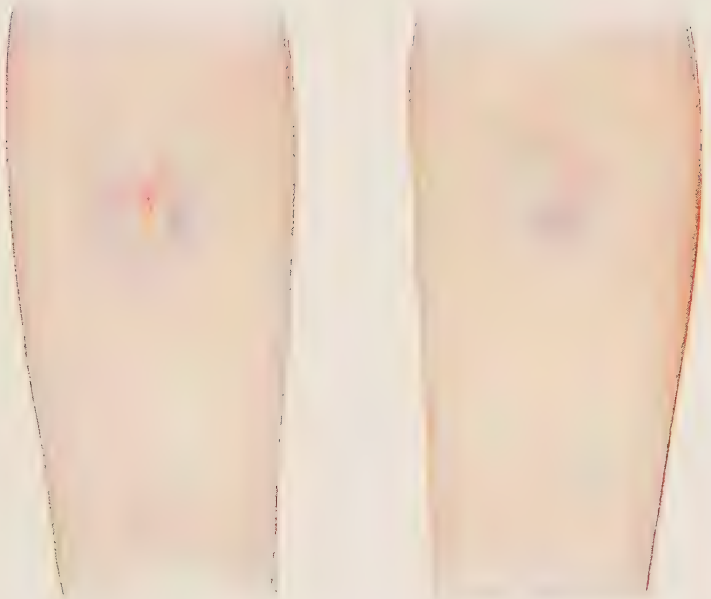
Left

A positive Schick test at seventy-two hours.

Note circumscribed area on the left forearm and nothing but a scratch on the right forearm where the control test was made. Had the test been negative both arms would have appeared as the right arm appears.

PLATE VI

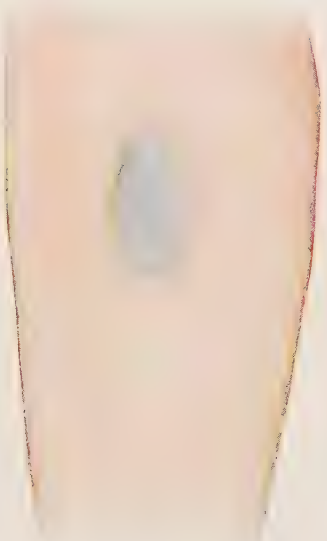
FIG. 1



A pseudo negative reaction at seventy-two hours.

Both arms correspond; reddish discoloration being rapidly replaced by a bluish mottling; area is not circumscribed.

FIG. 2



Schick reaction after ten days.
Note bluish discoloration with desquamation.

seven years. This latter immunity, however, takes several weeks to develop, and for this reason the prompt use of antitoxin is essential if exposure has occurred and the test is positive, the toxin-antitoxin being too slow for immediate protection. The dose of toxin-antitoxin is 1 cc. hypodermically, repeated every five days for three doses. As there is a possibility of this method failing to protect, its efficiency, in a given case, should be tested by the Schick method. Children over eight years of age, and adults, may develop a more or less sharp local reaction from the protein in the toxin of toxin-antitoxin. There may also be some febrile movement. This diphtheria prophylactic is now placed on the market in sealed bulbs and syringes, properly labelled as to dosage. Toxin-antitoxin should not be used if it has been frozen at any time.

1. To sum up: If a child has been directly exposed to diphtheria 1000 or more antitoxin units should be given at once unless there be danger of anaphylaxis from horse serum given at some previous time. If so, use Schick test or Bezredka's method.
2. When not exposed, in the presence of an epidemic, use the Schick test and if it is positive give toxin-antitoxin. This is essential in schools and orphanges.
3. Infants under six months do not need the Schick test or antitoxin as they are usually immune, nor do they for this reason need toxin-antitoxin.
4. When antitoxin or toxin-antitoxin has been used and a negative Schick test obtained the physician in the presence of a fresh epidemic should use the Schick again if several months have elapsed.
5. It is not to be forgotten that if all children of school age are tested and protected by toxin-antitoxin diphtheria can be made as rare a disease as is smallpox where vaccination is generally practised.

When toxoid is used intradermally to determine susceptibility 0.1 of dilute toxoid is employed. (See below.)

It would appear that in the near future the use of toxin-antitoxin may be displaced by toxoid or anatoxin. In toxoid the toxin is destroyed by formaldehyde and heat instead of being neutralized by antitoxin. It has the advantage that one injection may be sufficient to immunize instead of three, in other words the desired result is reached more rapidly. Toxoid dilute is marketed in 1 cc. ampoules ready for use but when such a strength is used it is needful to give two doses, one at once and another in five days. Some give 0.5 cc., after three weeks 1 cc. and a third dose of 1.5 cc. three weeks later. Toxoid may cause a reaction which when it occurs produces locally a small sensitive red zone and a slight rise in temperature with a mild sense of malaise, probably due to foreign protein. Reactions are less frequently met with in children under six years than in adults. The immunization lasts for several months and in some persons for several years. Toxoid does not sensitize the patient to horse serum for obvious reasons.

The question as to whether toxin-antitoxin may be injurious to a child who has at some time received a serum derived from the horse is still subjudice. Probably it is not.

If the physician fears anaphylaxis because the patient has previously received horse serum he should employ that toxin-antitoxin which the latter is derived from goat serum.

Great care as to the prevention of the disease is needed. All cases should be carefully isolated; children who have been exposed should be quarantined for fourteen days; persons in perfect health who have been nursing such patients should also be quarantined, for in the secretions of the throat diphtheria bacilli may be carried by an apparently healthy nurse to another patient. The nurse and physician should therefore gargle with saline solutions and follow this by antiseptic mouth washes (see Iodine and Hydrogen Peroxide), using the greatest cleanliness as to the hair, hands, face, and clothing.

The maintenance of the patient's strength during an attack of diphtheria is of great importance. Simple, easily swallowed, and easily digested food should be freely given, and plenty of water provided to allay thirst and flush the kidneys of poisons. Milk, predigested or plain, is useful, as is also properly made beef-tea (see Feeding the Sick); soft eggs, etc., are to be given; and if swallowing is difficult because of soreness or paralysis, then we must feed by the use of the soft-rubber nasal tube, inserted through the nasal cavities into the pharynx after being well oiled with albolene. (See Gavage, Part III.) Such a method of feeding may be resorted to in cases of inability to swallow arising from paralysis and consequent regurgitation, and when coughing prevents swallowing. It is also useful when vomiting follows swallowing, as it often does not follow nasal feeding. It is best to make any needful applications to the throat before giving the food, in order to avoid vomiting induced by the application.

Feeding by the rectum may also be resorted to, and hypodermoclysis is not to be forgotten for the purpose of supplying fluid to the tissues.

Cardiac failure is so often dependent on advanced degenerative changes in the heart muscle that little can be done for relief. The best results seem to occur from the intravenous injection of 10 per cent dextrose solution. (See Intravenous Injection, Part IV and Dextrose, Part II.)

Atropine to contract the splanchnic vessels is useful. Aromatic spirit of ammonia may be used, with strychnine or caffeine hypodermically, but it is doubtful if adrenalin or pituitary should be given as they may induce fibrillation. As inversion of the T-wave in the electrocardiograph is present in a large percentage of cases of diphtheria and as digitalis in full dose causes such inversion even in those who are well it must not be given at all or with great caution.

If suffocation is imminent, inhalations of oxygen are to be used, passing the gas through a catheter which is pushed through the nose, and down the trachea if possible. Intubation or tracheotomy may have to be resorted to.

Steam set free in the air of the room is very useful as an adjuvant to local treatment, and the bronchitis-tent may be used in laryngeal cases.

During convalescence, tincture of the chloride of iron, quinine and strychnine are of service to keep the kidneys active, to stimulate the heart and respiration and to support the vital forces. The dose of the tincture of iron may be as much as 2 minims (0.1) every three hours, well diluted with water, to a child of four years.

When the glands of the neck threaten to suppurate, ice-bags should be applied to the throat and pieces of ice held constantly in the mouth, while antitoxin is pushed in as full amounts as possible.

During convalescence the patient should be kept at absolute rest in bed for a long time to avoid heart failure.

Chlorate of potassium has been used purely empirically in the treatment of this disease, but it should never be given internally, as the kidneys are already overburdened, and this drug is not only useless but is in addition a renal irritant. Although the author has been criticized for this last statement, he is convinced of its truth. It tends to disorder the stomach and exercises no useful function whatever.

DROPSY.

Dropsy is to be regarded as a symptom (not as a disease in itself) which may arise from many causes, such as cardiac, pulmonary, or renal diseases, or it may depend upon obstruction, from various causes, to the normal flow of the blood and lymph through the vessels and tissues. In other instances dropsy develops because of changes in the blood plasma, and in still others as a result of abnormal changes in the bloodvessel walls. In certain instances there is an increased hydrophilia of the tissue colloids. Its existence is dependent upon so many causes of a still more indirect nature that it is almost impossible to notice all of them, but the following consideration of the subject will at least make clear some of the reasons for its occurrence and indicate the means which are to be taken for its relief.

At the very start we are confronted by facts which seem paradoxical, but which are in reality quite reconcilable. These are, that low arterial pressure predisposes to dropsy, and that high venous pressure does likewise, or, in other words, that the cause of transudation on one side of the circulation is its prevention on the other.

The explanation of these statements lies in a thorough understanding of the physics of the circulatory system and its physiological function. It will be remembered that dropsical exudation takes place from the capillaries, and that the integrity of the walls of the bloodvessels and lymphatics depends upon normal nutrition, or, in other words, upon a proper blood supply. As a consequence, dropsy may be due to poorly nourished vessels as much as to any other cause. The force exercised upon the column of blood as it is driven out by the heart into the aorta may be considered as the chief support of the capillary circulation, so that if the heart be weak the pressure falls in the arteries, and in consequence the rapidity of flow is decreased in the capillaries, while, on the other hand, an increased cardiac activity hastens the capillary circulation. As the arterial pressure and force depend not only upon the heart force, but also upon the tonicity of the arteries which carry the blood stream, it becomes evident that dilated arteries must lower blood-pressure even if the heart be strong, although practically the heart and vasomotor system generally fail or increase in tone together. We find, therefore, that a weak heart or a relaxed artery tends to cause stagnation of the blood in the capillaries, and, having found that such stagnation tends to produce transudation, it is not difficult to understand why low arterial pressure aids in the development of dropsy.

Having shown this to be true, let us turn to an explanation of the fact that a high pressure in the veins is productive of the same changes. Here the normal pressure is almost nothing, being much less than in the arteries, and considerably less than in the capillaries. The result of this is, that in health the blood flows rapidly from the high pressure of the artery to the low pressure of the vein, and passes through the veins under a gradually decreasing pressure until it reaches the heart. Any obstruction to this venous flow must increase the venous pressure, and, the venous pressure being increased, the rapidity of flow through the capillaries must be decreased.

In cardiac disease dropsy is due to a weak heart being unable to supply the arteries with enough blood to maintain the normal pressure, or to a damming-up of blood in the venous system as the result of the imperfect emptying of the cardiac cavities. In the first instance low arterial pressure produces dropsy; in the second, high venous pressure has a similar effect.[1] But this does not entirely cover the problem, because, as already stated, dropsy must after all largely depend upon the permeability of the capillaries, upon conditions which cause the tissue colloids to take up abnormal amounts of fluid, and upon alterations in osmotic pressure. That hydrophilia of the tissues exists is proved by the fact that in renal disease the intracutaneous injection of a few minims of salt solution results in its speedy absorption far more rapidly than in a healthy person.

Space does not permit an adequate discussion of these factors, but that such abnormal changes take place is certain. Certain toxic agents alter the capillary walls, changes in the sodium and calcium in the blood stream may do likewise or alter the ability of the tissues to take up fluid. So, too, such basic substances change the processes of osmosis. At present we do not know positively whether the retention of sodium, for example, causes retention of fluid or whether retention of fluid induces retention of salt. So, too, it may be stated that while an excess of sodium may cause the tissue colloids to be hydrophilic, an excess of calcium may have the reverse effect. Diminishing sodium intake may therefore tend to relieve dropsy in some patients and administering calcium may have the same effect, and furthermore if calcium chloride is given it is to be recalled that the calcium ion is chiefly eliminated by the bowel and the chlorine set free may combine with some of the excess of sodium present and so cause its elimination as sodium chloride, or the increase in calcium may diminish the ability of the tissues to take up fluid. (See Calcium.)

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[1] For an explanation of these changes in the action of the muscle, valves and cardiac action in heart disease, see the article on Heart Disease.

In renal disease dropsy depends upon the lack of proper nutritive processes in the capillary walls and upon changes in the blood and tissues just described. If the kidney is diseased, it may not be able to eliminate the proper quantity of liquid which accumulates, while the same failure in renal function causes disease of the bloodvessels themselves, and often produces cardiac complications. In other cases the inability to eliminate salts results in their retention and the fluid is retained in order to maintain normal tonicity of the body juices. In these cases a salt-free diet is essential and full doses of ammonium chloride may be used or calcium chloride given.

Pulmonary disease rarely causes dropsy unless the changes in the nutrition of the body involve the heart, the bloodvessel walls and the blood.

Having spoken of these causes of dropsy, it remains to consider its treatment, which may be divided into two parts—namely, that directed to its removal after the liquid is poured out, and its relief or cure by direct attention to its causes. Whenever an accumulation of liquid takes place in the tissues, drugs or measures must be resorted to which will cause the emunctories of the body to get rid of it. We may employ elaterium in the dose of $\frac{1}{6}$ grain (0.01), or elaterin in the dose of $\frac{1}{20}$ grain (0.003), placed in the mouth and washed down by a little water, or the compound jalap powder may be resorted to in the dose of 20 to 30 grains (1.3–2.0), and to it may be added, to increase its efficiency, 15 grains (1.0) more of bitartrate of potassium than the official powder contains. These two remedies are particularly serviceable in renal dropsies, since the elaterium is supposed to aid in the elimination of urea by the bowel, while the cream of tartar in the jalap powder increases the action of the kidneys.

The cream of tartar is not to be employed in cases of acute nephritis.

Compound extract of colocynth may be employed in the dose of 15 to 30 grains (1.0–2.0), according to the state and idiosyncrasy of the patient. Very active purgation is contraindicated if the heart is feeble.

All these remedies relieve dropsy by causing so great an outpouring of liquid from the bloodvessels of the intestine that the liquids in the tissues are taken up by the depleted bloodvessels to replace the loss through the action of the purgative. In other words, these purgatives render the salinity of the blood greater by concentration, and absorption of fluid occurs by reason of the following physiological and physical facts:

As is well known to every physiologist, the passage through a bloodvessel of a salt solution of less than 0.9 per cent causes an abstraction of salts from the surrounding tissues by the circulating fluid, in order that the amount of salts in the vessels and tissues may be identical. At the same time the tissues become infiltrated with liquid. On the other hand, if the solution be stronger than the normal 0.9 per cent, the liquid leaves the tissues to enter the vessels, and the tissues in consequence shrink.

When salines are given to relieve dropsy, they must be administered in concentrated or saturated solution and on an empty stomach, total abstinence from the drinking of water being insisted upon until they have fully acted, for the reasons given in the last paragraph. For this reason they should be given an hour or so before breakfast. If these directions are not followed, this method of treatment is useless. (See Magnesium Sulphate.)

The other means which we possess for the removal of dropsy are by way of the kidneys and skin. If the kidneys are hopelessly diseased, that pathway is almost useless; but if they are only passive or partly inactive, diuretics may be used to stimulate their secreting structure and to increase the leakage of liquid through them by increasing blood-pressure.

Closely allied to this plan is the so-called Karell method which consists in starvation of the patient as to both liquids and solids. At the start only ½ glass of skimmed milk is allowed the patient at intervals of two hours, but not more than 800 cc. is permissible. The milk must be sipped, not gulped, and the quantity is gradually increased so that at the end of two weeks the total amount of milk is doubled. If thirst is uncontrollable a very little water or coffee is permitted and if hunger is so great that the patient threatens to break the rules a small portion of bread is given. This method is said to be of the greatest benefit in cardio-renal dropsy, but it is evident that if a patient is very feeble or the heart muscle is degenerated it must be attempted, if at all, with caution. It is certainly much too rigorous for many patients.

It has been proved that in acute and chronic parenchymatous nephritis the kidneys are often unable to eliminate the daily quantity of chlorides which they excrete in health, and it is considered by many that the resulting accumulation of sodium chloride in the tissues requires an excess of water to be retained to maintain the normal molecular concentration, and that this in turn results in dropsy. Further, it has been proved that if some of these cases are placed upon a diet which contains less than 45 grains (3.0) of salt a day, they develop diuresis and the dropsy decreases in some instances, because the tissues are no longer loaded with chlorides. As milk is low in chlorides this may be one of the reasons why it is useful as a diet in nephritis. Unless it can be shown that there is an inability of the kidney to eliminate salts it is unwise to use a salt-free diet for salt is normally a food.

Often the kidneys will be found inactive because, owing to congestion from cardiac trouble, they cannot act. Under these circumstances digitalis, in 10 to 15-minim (0.65–1.0) doses of the tincture, given three times a day, will be of value, and its efficacy will be increased by the addition of 2 grains of caffeine twice or thrice a day in many cases. Digitalis and squill, in pill form, as follows, may be used:

℞—Pulveris digitalis	gr. xx (1.3)
Pulveris scillæ	gr. xx (1.3).—M.

Fiant pilulæ, No. xx.
S.—One every five hours.

Or digitalis and calomel may be employed in pill form in renal and cardiac dropsies. (See Novasurol and Salyrgen, Important, Part II. They are not to be used in renal dropsy.)

Caffeine is a useful diuretic, particularly in torpidity of the kidneys, as it stimulates the secretory epithelium, thus increasing the eliminating of solids and increases the passage of liquids by the increased blood-pressure which it produces.

Pituitrin, given in the dose of 15 minims (1.0) hypodermically or by the mouth twice a day, is often an efficient diuretic in cardiac dropsy.

No drug should ever be given hypodermically in dropsy of a general character, as it will not be absorbed from the water-soaked tissue with any rapidity, if at all.

The chief means of relief to be resorted to in cases of ascites is tapping. Efforts to remove effusion in the peritoneal cavity by medicinal measures are rarely followed by success. In reality, tapping is far less heroic treatment than purgation, and the old theory that it is dangerous has been disproved. It has been found that tapping not only removes the fluid, but may in certain cases of hepatic cirrhosis produce a permanent cure after from one to twenty or more operations. In performing tapping, the patient is to be placed in a sitting or semi-recumbent position, and directed to evacute his bladder, so that there will be no danger of this viscus being injured by the trocar. The skin of the abdomen in the middle line 1 or 2 inches below the umbilicus is rendered antiseptic with tincture of iodine and benumbed by the subcutaneous injection of a few drops of a solution of procaine or cocaine. The physician then takes a trocar and cannula, at least 4 inches long, and pushes it through the abdominal wall until by the decrease in resistance he knows the point has entered the abdominal cavity. It is well to have a broad abdominal bandage placed around the belly, so that an assistant by pulling on its ends may support the belly-walls when they become relaxed by the escape of the effusion. As a rule, not more than one-half or three-fourths of the liquid should be removed at one sitting, as its entire removal may be followed by collapse or by rapid formation of fresh transudate.

The value of iodide of potassium in cases of ascites is not to be forgotten, but it must be given cautiously if renal disease is present.

Dropsical patients can sometimes be relieved of large amounts of fluid by elevating the head of the bed and introducing into each leg a cannula to which are attached rubber tubes the lower end of which are placed in bottles, one of which is hung on each side of the bed. When this plan fails and the tenseness of the skin in the lower extremities causes danger of local sloughs, several free incisions for the escape of the liquid should be made, the limbs being encased in sterilized gauze to absorb the liquid. These wounds usually soon fail to drain freely and may slough. They are to be regarded as a last resort. (See Nephritis.)

DUODENAL ULCER.

(See Gastric and Duodenal Ulcer.)

DYSENTERY.

(See Diarrhea and Dysentery.)

DYSMENORRHEA.

The existence of dysmenorrhea depend upon so many conditions that the treatment employed in one case often fails to produce success in the next. This is not the place for a consideration of the surgical measures adopted for the cure of this symptom, and only the medical treatment will be spoken of.

When dysmenorrhea results from the taking of a cold, and is accompanied by uterine congestion and irritability, the following measures are particularly valuable, and may do good in many cases depending upon other causes: The patient should take a hot sitz-bath, and immediately get into bed as soon as the buttocks are dried, being well covered, while in the tub and afterward, by a blanket. A turpentine stupe is now to be used (see Turpentine), and 10 grains (0.6) of Dover's powder to be administered unless an idiosyncrasy toward opium is known to exist, when a half or a fourth of this amount may be employed or 10 grains (0.6) of Tully's powder employed. Often when the attack is accompanied by constipation a purgative dose of Epsom salt is of service.

If the pain is persistent and severe, a suppository of 1 grain (0.06) of the extract of hyoscyamus may be inserted into the rectum.

The latter method is generally impracticable and is rarely resorted to. Very commonly full doses of tincture of hyoscyamus is of service in relaxing the spasm of the cervix and of the uterine fundus.

Some practitioners resort to the use of opium at each epoch, and keep the patient partially narcotized until menstruation is passed. This is unjustifiable since the physician is simply dodging effective treatment of the trouble and predisposing the patient to future attacks by reason of the constipation and the resulting habit which is almost sure to appear after the repeated employment of opiates.

When the dysmenorrhea is due to obstruction of the cervical canal by organic changes or flexions, these conditions must, of course, be relieved before a cure can be expected, and the medical treatment can be directed only to alleviation of the pain. Divulsions or slow or rapid cervical dilatation should be carried out by the use of instruments.

In neuralgic dysmenorrhea, dependent rather upon nervous disorder accompanying menstruation than upon menstruation itself, measures directed to the improvement of the nervous system and the nutrition of the patient are necessary. (See Rest Cure.) These cases generally occur in nervous anemic women, run down by excessive gayety or by the bearing and care of a large family of children. Dysmenorrhea is, however, rarely met with in the latter type of patient.

A course of strychnine or quinine and iron in small doses is often beneficial in these cases, and horseback exercise between the menstrual periods, out-of-door life, and avoidance of excessive dancing and exhausting exercise are to be ordered.

Cannabis and gelsemium are often of great service, both as cures and alleviators of the pain, and antipyrine, acetanilid, and similar drugs may be resorted to while the attack lasts if it be neuralgic.

Sometimes bathing the loins, between the periods, with alternate dashes of hot and cold water may do good in atonic patients. In other cases a hot vaginal douche at the onset of pain may give relief.

When the pain seems to be greater than the patient can bear, enough ether or chloroform should be given by the physician, by means of inhalation, to produce the primary stages of relaxation. Chloral and other drugs capable of causing a habit are to be carefully avoided for obvious reasons.

DYSPEPSIA.

(See INDIGESTION.)

DYSPNEA.

Shortness of breath, or dyspnea, arises from asthma, cardiac weakness, from the accumulation of fluid in the chest, from the involvement of the lungs by any disease process in such a way that respiration becomes impaired, or it is produced by indigestion, or, finally, by the encroachment on the lungs or chest-walls of morbid growths. It may also be due to uremic or diabetic toxemia.

Each of these states must be removed to effect a cure, but it is only of the relief of the symptoms that I will speak.

In old persons who suffer from dyspnea the result of bronchorrhea, when a large amount of liquid fills the bronchial tubes and shortness of breath follows exertion, strychnine or caffeine is the best remedy. Its value depends upon its powerful influence over the respiratory center, on which it acts as a stimulant; and as these cases very commonly also have dilatation of the right side of the heart, with consequent cardiac enfeeblement, strychnine is of additional service through its influence upon the circulation. These individuals are not to be given opium or its alkaloids or any sedative drugs, as such medicines, while giving temporary relief from cough, only serve to depress the cough center and cause an accumulation of liquid mucus in the chest as a result of the prevention of cough and expectoration. The cases in which codeine, or morphine, does good are those in which some focus of irritation induces excessive cough, which in turn may induce a traumatic bronchitis, but above all, in those instances in which dyspnea occurs as the result of cardiac disease. In these cases the attacks of oppression and suffocation can often be entirely prevented by the use of $\frac{1}{8}$ to $\frac{1}{4}$ grain (0.008–0.015) of morphine, given every night or each night and morning. If these doses fail larger ones may be cautiously used. Hyoscine, instead of causing sleep, nearly always makes these cases worse.

Sometimes a little carbonate of ammonium is useful as a respiratory and cardiac stimulant in cases of dyspnea.

Dry cupping applied over the back of the chest may also be serviceable when shortness of breath from cardiac weakness induces pulmonary congestion and digitalis in full dose is usually essential.

In cases of dyspnea due to emphysema and bronchitis of a chronic type, or in those persons who take cold on the slightest exposure, particularly after attacks of asthma, arsenic is useful if continuously employed. (See Chronic Bronchitis.)

If pleural effusion be present, relief of a positive and lasting nature can only be obtained through aspiration, or, in other words, by the operation known as paracentesis thoracis.

EARACHE.

Earache may arise from a great number of causes, all of which are, practically speaking, inflammatory. The pain may be the result of acute or chronic inflammation of the middle ear, with a serous or purulent exudate, or of furunculosis of the external auditory canal. In other cases an eczema of this part is very painful.

The treatment of an acute earache is systemic and local, the former being based on the general rules governing the management of inflammatory processes, the latter according to the area involved and the cause of the trouble. Cardiac sedatives are indicated, but quinine and salicylates are distinctly contraindicated, as they tend to cause aural congestion. In the general treatment several leeches may be placed in front of or behind the ear, and heat in a dry form is to be applied to the head on the side affected, by means of a hot-water bottle or electric lamp. Poultices, oil and laudanum, and similar applications are *not* to be resorted to, as they may ultimately produce extensive suppuration, and they do not always give even temporary relief, but tincture of belladonna and tincture of opium in equal parts carefully warmed may be dropped in the ear in the dose of 5 to 10 minims (0.3–0.6) when necessary.

If a cold in the head is present, and with it acute myringitis, it is important to establish a free opening through the nostrils, particularly if the middle ear also is involved, in order to clear the orifice of the Eustachian tube. This is to be accomplished by dropping into each nostril adrenalin chloride (1:5000 solution) or 1 to 3 minims (0.06–0.2) of a 4 per cent solution of cocaine, or a 2 per cent solution of ephedrine hydrochloride, and, as soon as the engorged mucous membrane is anesthetic and shrunken, to use the following solution in an atomizer with a fine spray attachment:

℞—Acidi borici	gr. x (0.6)
Sodii chloridi	gr. xij (0.8)
Sodii boratis	gr. x (0.6)
Aquæ rosæ	q. s. ad f℥iij (90.0).—M.

S.—Use as a spray.

This should be followed by a spray of menthol and albolene, 3 grains to the ounce (0.2 to 30.0), in order that the menthol may prolong the effect of the cocaine and prevent secondary congestion. Opiates, if used at all, must be employed with caution lest they by relieving pain delude the patient and physician into the belief that the trouble is subsiding.

Counterirritation over the mastoid should not be applied as its presence may mask the signs of mastoid disease and damage the skin in an area in which an operation may become necessary.

Should true septic otitis media develop and drainage of the middle ear become impossible through blocking of the Eustachian tube, and as soon the tympanic membrane begins to bulge, paracentesis must be performed in the most bulging part of the lower quadrant. After the paracentesis knife is withdrawn the discharge should be allowed to flow freely. The canal is then to be well irrigated with hot 1 to 2000 permanganate of potassium or hot carbolized water (1 to 50). Often the use of a medium dropper is sufficient. If the discharge is constant a thin piece of sterilized gauze should be inserted and allowed to act as a drain (not as a packing) and removed as often as soiled, care being taken that the canal is kept clean by swabbing.

In a case of eczema of the ear, hot irrigation, followed by the application of powdered iodoform, is perhaps the best application for temporary treatment. In furunculosis of the ear hot irrigations and free incision, with an iodoform dressing, are useful.

When foreign bodies cause the pain, they are best removed by repeated and gentle syringing with hot water. Forceps are dangerous instruments in the hands of a novice treating the ear.

In earache due to neuralgia a small compress wet with chloroform may be applied to the skin in front of and behind the ear.

ECZEMA.

This is probably the most common form of skin disease which the physician is called upon to treat, with the exception of acne.

Dermatologists divide it into many forms and stages, but in this book a consideration of its forms is out of place, and only the treatment for its stages is proper.

In the first place, it may be stated that the treatment is a quadruple one—namely, dietetic, hygienic, external, and internal.

In regard to diet, the patient should be told to avoid salty foods, such as salted fish or pork and corned beef; greasy foods, such as bacon and fried dishes; pastry and cheese. At most only moderate amounts of alcoholic drink may be taken, and foods difficult of digestion are to be stricken off the bill of fare.

In the way of hygienic measures, fresh air, the avoidance of sedentary habits, horseback exercise or walking are to be recommended.

External treatment is the most important of the two measures in which drugs are employed, and its course is perhaps best described by taking a case of ordinary eczema as an example and treating it through its entire course.

In the early stages of an acute eczema, when the process is very active and the erythematous reddening is merging into the formation of vesicles or pustules, with the formation of large scabs, no application is better than oxide of zinc ointment, thoroughly applied night and morning. If the eczema be situated upon the scalp, the hair must be invariably clipped short or shaved off in such a way as to prevent the gluing of the hair into a mat by reason of the discharge. The ointment may be smeared over the part or applied on a piece of lint in a thick layer. Nearly always the ointment should be used in conjunction with black wash (calomel 1 dram [4.0], lime-water 1 pint [480.0]), which should be applied twice a day, just before the zinc ointment is resorted to, by means of a swab or sop, and allowed to dry. In other cases the powdered oxide of zinc is dusted over the part if the discharge is very watery and profuse, or the following ointment, recommended by McCall Anderson, is very efficacious:

℞—Bismuthi oxidi	℥j (30.0)
Acidi oleici puri	℥viij (240.0)
Ceræ albæ	℥iij (90.0)
Petrolati	℥ix (270.0)
Olei rosæ	♏v (0.3).—M.

Fiat unguentum.
S.—Apply to the part affected.

As the quantities of this prescription are large, they may be reduced one-half for use in localized eczema.

Where the proliferation of cells and the secretion are very profuse it may become necessary to remove the crusts before the local remedies can reach the skin, and for this purpose poultices may be used; or, if the disease be on the face, the parts should be anointed with olive oil, containing 1 or 2 minims of phenol to the ounce (0.06-0.12 to 30.0), to soften the crusts, which are readily removed in a half-hour by the use of castile soap and water. The soap and water are not to be used if the inflammatory area is very angry looking. (See end of article.) Whenever itching is an annoying factor the parts should be protected by lint smeared with some simple ointment, which may be carbolized, both for its antiseptic and local anesthetic effect. English and American dermatologists use what is known as liquor carbonis detergens very largely in the acute stages of eczema. It should not be used pure, but diluted in such a way that for each 4 ounces (120.0) of water 2 drams (8.0) of the pure liquor are present. Liquor carbonis detergens is made by taking 9 ounces (270.0) of tincture of soap-bark (quillaja bark) and 4 ounces (120.0) of coal-tar, mixing and allowing them to digest for eight days, after which the mixture is filtered and is then ready for use.

In infants light splints may be put on the arms to prevent the child from scratching the parts, and if there is a free outpouring of serum the following lotion may be dabbed on the inflamed area every few hours:

℞—Phenolis	♏xv (1.0)
Ichthyolis	ʒj (4.0)
Zinci oxidi	ʒij (8.0)
Magnesii carbonatis	ʒij (8.0)
Liquor. calcis	f℥iv (120.0).—M.

S.—Use locally.

If crusts are present the following may be placed on a piece of lint in which holes are cut for the nose, eyes, and mouth, tapes being attached to the edges of the lint, so that it can be held on the child's face by tying them back of the head:

℞—Acidi salicylici	gr. iv (0.3)
Ichthyolis	gr. xx (1.3)
Zinci oxidi	gr. xxx (2.0)
Unguent. aquæ rosæ	℥ij (60.0).—M.

When the disease has passed from the acute, active inflammation of the first stage to the subacute form of the second stage, applications of a mildly stimulant character are necessary. Before this the aim has been to soothe the parts; now they must be excited to normal activity. For this purpose resorcinol in the proportion of 2 to 30 grains to 1 ounce (0.12–2.0 to 30.0) of lard, according to the severity and induration of the lesion in the skin, may be used.

Where the disease is chronic and very persistent, and sluggish or atonic in its course, still more powerful remedies are necessary, such as salicylic acid, tar, or tincture of green soap used with hot water until the skin beneath is bared, dressing this by means of zinc ointment or resorcinol ointment, 2 to 10 grains to the ounce (0.12–0.6 to 30.0), spread on a cloth. The salicylic acid should be used in the proportion of 30 to 60 grains to 1 ounce (2.0–4.0 to 30.0) of lard, while the tar is used in the form of the pure official tar ointment.

℞—Unguenti picis liquidi	ʒj (4.0)
Unguenti zinci oxidi	ʒvij (28.0).—M.

S.—Apply to the parts.

In seborrheic eczema, where the secretion is greasy and dry, and complicated, if wrongly treated, by oozing and the pouring out of serum and the formation of cells which form crusts, the following prescription is of value:

℞—Resorcinolis		gr. x vel xx (0.6–1.3)
Pulvis amyli,		
Unguenti zinci oxidi	āā	ʒij (8.0)
Petrolati		℥ss (16.0).—M.

Sig.—To be applied after removing the scabs by the use of a lotion composed of 1 part of bay rum and 3 parts of water.

The internal treatment is directed to the cure of any disordered function which is present, such as dyspepsia (see Indigestion), hepatic torpor, general debility, anemia, scrofulosis, inanition, constipation, gouty diathesis, or renal insufficiency. The gastric disorder is to be relieved by the use of hydrochloric acid and pepsin; the hepatic torpor by mercury, podophyllin, or, better still, by freshly prepared strong nitrohydrochloric acid added to water; the debility by tonics, such as cinchona, cod-liver oil, strychnine, and bitters; the anemia by iron, and, if adenitis exists, by the syrup of the iodide of iron. Constipation is to be cured by the use of proper foods and laxatives, and the gouty tendency counteracted by the employment of the salicylates, neocinchophen, colchicum, or potassium iodide. If the kidneys are at fault, because of torpidity, the diuretic potassium salts, such as the citrate, are indicated. Arsenic is never to be used, except in those instances where the skin is very dry, and where, by improving digestion and through its alterative power, it may do good. In the chronic forms of dry eczema or those depending upon an atonic state of the trophic nerves of the skin, arsenic is of great value in the form of Fowler's solution, or arsenic trioxide may be given. (See Arsenic, Part II.)

The question as to how the skin may be cleansed when suffering from acute eczematous eruptions is important, particularly as to the hands, since soap and water are always deleterious. Glaze recommends the following method whereby soap is avoided:

Oil of sweet almonds may be placed in a salt shaker and then a considerable quantity is shaken into the palm of the hand, where it is gently but thoroughly worked into the skin. After this a small portion of the yolk of an egg is added and the two rubbed together just as one would lather the hands with soap. At this time add a few drops of water and continue lathering. Rinse clean with cool water and dry by means of compressing the parts with a towel. After the eruption is cured the tendency to recurrence may be corrected by the same method, using instead of the yolk of egg some very mild soap, such as a shaving soap.

EMISSIONS.

Excessive seminal emissions result from sexual abuse, whereby a condition of hyperexcitation of the nerve cells in the spinal cord and the nerves of the genitalia are developed, or they are due to peripheral or centric irritations, which reflexly irritate the genitalia or their nerves, and to a number of other similar causes. These emissions also occur with some periodicity in normal males who are continent and chaste, and under these circumstances are not to be interfered with by treatment unless the emissions become excessive.

The former types are, however, proper for medical treatment, and their cure consists in the avoidance of unchaste literature and lascivious thoughts during the waking hours, and the use of such spinal and cerebral sedatives that the centers governing the ejaculations of semen may be calmed, and so quiet a sleep produced that erotic dreams are avoided. The patient should sleep on a hard hair mattress, not be too heavily covered, and should avoid sleeping on his back, as this causes an undue blood supply to the spinal centers, and consequent stimulation and ejaculations. Sometimes hard bodies, such as spools, are tied around the loins, so that lying on the back will cause so much discomfort that the patient awakes and turns on his side. The drugs to be used are bromide of potassium or sodium in 20-grain (1.3) doses at bedtime, or chloral may be taken in the same amount. Hyoscine is certainly of value in the dose of $\frac{1}{100}$ grain (0.0006). Sometimes a warm sitz-bath or general bath before going to bed is of service. In other cases, where atony is the cause of the trouble, the physician should recommend cold sponging of the perineum and loins night and morning.

In the cases in which emissions come on as the result of continence, and become excessive, the remedies just named are to be tried, but do not effect any permanent cure unless used until sexual power is seriously depressed, so that it has been the custom of many physicians to recommend "marriage," which the patient may interpret in its legitimate light or not as he pleases.

It is worthy of note that all irritations of the urinary bladder and other parts of the genito-urinary system should be removed, and it is often of value to administer citrate of potassium in 20-grain (1.3) doses, in water, three times a day, to render the urine non-irritating and alkaline. Stimulating foods and drinks are to be interdicted, and condiments, such as pepper and mustard, avoided.

Sometimes, when the emissions are caused by *genital atony*, strychnine and arsenic are of great service if given in full dose.

In many of these cases it is the duty of the physician to treat the moral state of his patient as well as to give medicines. Many persons, believing that emissions are always an evidence of disease, read books on such subjects which are sold by quacks, and soon find their way to the hands of these persons. A few sensibly consult a regular physician. Half the treatment in these instances consists in assuring the patient that he has nothing to worry about, and in making him feel that the physician is his friend and worthy of all confidence and complete belief.

EMPYEMA.

(See Pleuritis.)

ENDOCARDITIS.

Endocarditis may be acute or chronic. Acute endocarditis occurs as a result of some general infection which is usually rheumatism.

In acute sthenic endocarditis tincture of aconite, 10 minims (0.65) given every hour until the physiological symptoms of its influence are present, is useful, or with equal efficacy may be employed the tincture of veratrum (10 to 15 minims [0.6–1.0]). In most cases it is better to apply an ice-bag over the heart. Aconite and other depressants are contraindicated if the heart is at all feeble, and should only be used in the earliest stages of the disease. The most important measure is absolute rest upon the back. This must be insisted upon. If the cause of the disease is acute rheumatism, a number of small blisters placed on the precordium will be of value in preventing pericardial complications. (See Acute Rheumatism.) In sub-bacterial endocarditis, so-called, treatment by drugs is useless but supporting treatment, by the use of good food and the free administration of the tincture of the chloride of iron, may be resorted to.

EPILEPSY.

The disease known as epilepsy is probably the most disheartening condition as to treatment that the physician has to deal with, since it often resists the influences of all the standard remedies, and drives the practitioner from drug to drug in the hope of finding one which will be at least alleviating in its effects. For this reason the author has in this article included many of the drugs which are rarely used, as well as those generally recognized as useful in its treatment, in order that the physician may try every remedy of any possible value. It is evident that in cases such as these the physician cannot hope to cure the patient permanently, although by proper feeding, hygienic measures, and suitable drugs and tonics he may diminish the attacks very greatly. So, too, by removing causes of peripheral irritation he may diminish the frequency of the attacks, but he cannot eradicate the underlying nervous instability. If the condition arises in adult life, it is in the great majority of cases due to syphilis, to brain tumor, or to injuries of the skull. Under these conditions the prognosis and therapeutic possibilities are better than in the type just described; but if the fits have lasted for any length of time, so that a state of instability of the cerebral cells has been established, the condition may be irreparable, even if the treatment be most skilful.

So far as drugs are concerned, the most valuable remedy hitherto in use for the relief of epilepsy has been bromide of sodium, although such excellent results have been obtained by the use of phenobarbital that it has displaced it. The dose, 1½ to 3 grains of phenobarbital is (0.18) at bedtime, and this may be fortified by 20 grains (1.3) of sodium bromide given three times a day. When phenobarbital sodium is used the dose is 2 grains (0.12), which may be increased to 5 grains (0.3).

Neither of these drugs are specific, but many cases prove that they give relief when used in a suitable manner. In my experience antipyrin in 5-grain (0.3) doses three times a day stands next in value.

A point to be considered is the condition of the digestion, which the bromide of potassium is peculiarly liable to disorder, and which is sometimes so disturbed as to necessitate the administration of the drug by the rectum in serious cases. Females generally require smaller doses than males, and children of both sexes do not require as large quantities as adults. The dose to be used in the beginning of the treatment in moderate case is but 10 grains (0.6) thrice a day; and while this may seem a very small quantity, it will be found that it can be rapidly increased in amount without causing the gastric distress produced by the sudden use of larger doses. Each day an additional 10 grains may be added, until at the end of a week the patient is taking 80 grains (5.3) in each twenty-four hours. There are very few cases which will not become saturated with the drug if this is done, and there are very few in which a more rapid arrival at bromism is needed. If, however, the patient has become able to stand large amounts by the prolonged use of the drug, the amount given is not to be governed by grains, but by physiological effects, and it may be pushed to any amount which is borne without distress.

Full doses of the bromides, particularly in epileptics of an advanced type, sometimes cause maniacal outbursts in place of the epileptic attacks. In other instances the patients become morose and homicidal. (See article by author in *Therapeutic Gazette*, June, 1897.) Cases are on record in which the persistent use of larger doses of the bromides has resulted in bronchitis with profuse and dangerous exudation, causing suffocative bronchitis.

When the bromides are taken for any length of time they produce bromism, which in its moderate or severe forms produces a mental condition closely allied to that seen in old, chronic epileptics. This condition of the mind should never be overlooked, and the ordinary mental changes of epilepsy are greatly aggravated by their constant and careless administration. (See Bromide of Potassium.)

Many European physicians have endeavored to aid the rapid saturation of patients by the bromides by depriving them of common salt, thereby causing the salt-starved system to absorb greedily the bromide of sodium. It is doubtful if this plan is justifiable.

As regards the time of day when the drug is to be taken, there can be no doubt. Some writers have directed that it shall always be taken before meals, but this is entirely lacking in advantage and decidedly fruitful of harm. Drugs which are given with the object of affecting the general system should be taken after meals, not before, and it is only when a local gastric effect is desired that they should be given on an empty stomach, particularly when the substance is so depressing as a salt of potassium. If taken after meals, the appetite is not decreased, but there are few who can take a dose of 10 or 20 grains (0.6–1.3) of bromide of potassium before breakfast without suffering from indigestion.

Bromide of sodium and bromide of strontium are not by any means so apt to disorder the stomach, and are preferable in most cases on this account. They possess no other advantage.

There can be no doubt that in some instances what is known as the mixed treatment is very useful. This consists most commonly of a prescription in which the bromides of potassium, sodium, and ammonium take part. Why this combination acts better than any one of the salts alone is unknown, but it is certainly a clinical fact.

Bechterew has recommended the joint use of the bromides with adonis vernalis in epilepsy as follows:

℞—Potassii bromidi		ʒiij (12.0)
Infusi adonis vernalis		f℥iv (120.0)
Aquæ destillatæ	q. s.	f℥vj (180.0).—M.

S.—A dessertspoonful three times a day.

Sometimes codeine is combined with this prescription.

It has been claimed by Flechsig that the use of opium for a long period of time is useful in the treatment of epilepsy. He gives the opium in ascending doses during a period of six weeks, beginning with $\frac{1}{4}$ grain (0.015) three times a day, and going as high as 5 grains (0.3) three times a day. This method decreases the frequency and severity of the fits for several months in some cases, but does not cause a cure. It succeeds best in old cases and is not useful in recent ones.

In still other cases digitalis, when used along with one of the bromides, seems to produce favorable results. Indeed, digitalis has for years been used alone in epilepsy with fairly good results, and should always be used in obstinate cases. In *petit mal*, in which bromide of potassium when used alone so often fails, it is useful, and several English writers, notably Gowers, asserted that its best effects are seen in cases of nocturnal epilepsy. Why this is the case no one knows, and it would seem doubtful whether it is more beneficial in nocturnal attacks than in others.

Another combination very much employed and lauded is bromide of potassium with belladonna, the mydriatic being almost useless alone, although of great antiquity in its use in epilepsy. Like the mixture of digitalis and bromide, it succeeds very frequently in *petit mal*, and, indeed, seems to be much more successful than the digitalis, but its mode of action is exceedingly doubtful. As the drug acts even more powerfully upon the nervous system than upon the circulatory apparatus, it has been thought that its influence for good depended upon this effect, but the experiments of Seppilli contradict this belief, for he found that if atropine was given to an animal the surface of the cortex cerebri responded more readily than is normal to electrical stimulation. At one time it was held that belladonna acted on the spinal cord and peripheral nerves under such circumstances, but it should be remembered that we now know that atropine is only of value in relaxing spasm when given in full dose, oftentimes hypodermically, and that Albertoni has made a series of experiments to determine whether it irritates the motor centers of the cortex. In his hands repeated small doses or one large dose in no way retarded the convulsions commonly produced by stimulation of the brain. Both these investigators are therefore in accord. Under these circumstances it affects rather the motor nerve-endings than the central nervous apparatus.

The use of the nitrite of amyl is not for the purpose of directly curing the disease, but of warding off impending attacks, the warning of which is given by an aura of slow progression. It often increases the severity of *petit mal*, but in epileptics who have a prolonged aura, nitrite of amyl pearls, which are small glass beads containing a few drops of the drug, may be used. As the aura comes on the patient should break one of these in a handkerchief and inhale the drug, thereby putting aside the attack. The influence which the drug exerts upon the brain is secondary rather than primary, and is probably dependent on its action on the blood or circulation. Its influence on the spinal cord and nerves is much more marked and direct, and it is most certainly a very powerful spinal depressant. Nitrite of amyl puts aside an attack by a sudden shock to the nerve-centers, which diverts them, so to speak, from their intended discharge, very much as a ligature around the arm stops an aura.

When we remember that the drug acts instantly and converts much of the oxygenating blood of the body into a non-oxygen-carrying fluid by reason of the methemoglobin produced, the sudden change in the cerebral nutrition and state is easily understood.

In the treatment of the "status epilepticus" nitrite of amyl is of great value in checking the seizures, and may be used under these circumstances in heroic amounts, applied to the nostrils at intervals. During the presence of the tonic spasm, if it be severe enough to suspend respiration, it should be remembered that if the drug is not inhaled it is worthless. It is only when respiration is being carried on that it can enter the lungs and do its work. Nitroglycerin may be used hypodermically to supplement the nitrite of amyl. Another valued method in treating the status epilepticus is free bloodletting. (See Phenobarbital, Part II.)

The use of anesthetics during an attack of epilepsy is virtually useless, and in some cases dangerous, for ether is too slow in its effects, and may, by its irritant vapors, increase the tendency to laryngeal spasm or cause lung complications. Further than this, if uremia is the cause of the fit—and this fact is unknown in every case when it is seen for the first time until the individual is carefully examined—the ether may further irritate the kidneys.

Chloroform, though it acts much more rapidly, may cause sudden cardiac failure, and both drugs may increase the postconvulsive coma very greatly. In status epilepticus they may be used, as in such case the convulsions must be stopped at all hazards, but the preference should be always for amyl nitrite, which may be given hypodermically.

The iodide of potassium is useless in epilepsy unless the disease is due to syphilis, when it is of the greatest service. Indeed, the bromide and all other drugs but mercury should be discarded while these are pushed to the utmost. As is well known, syphilitics usually bear iodides extremely well, and the author knows of one instance in which no less than 800 grains (53.0) were taken every twenty-four hours, with rapid improvement as a result. This point is strongly insisted upon by all therapeutists and syphilographers, notably Fournier.

Where the convulsions are due to the presence of a gumma, however, the iodide of potassium is too slow in its action, and mercury should be depended upon in order to break down the growth without delay, lest a seizure cause death by glottic closure, producing asphyxia or some similar accident.

Chloral possesses the disadvantages, as compared with the bromides, of being a very fatal poison, which is an important fact to be borne in mind by the physician when giving it to a patient whose mind is already weakened by the disease or who is naturally stupid, and who may forget the dose and take too much. Its physiological action indicates much more fully that it may be of value than does that of many other more lauded remedies, since it exerts its chief influence on the motor pathways of the spinal cord and quiets the intellectual portion of the cerebral cortex, and so produces sleep. Seppilli has proved this by direct experimentation after the method employed by Albertoni. Its use, combined with one of the bromides, is often followed by the most desirable results, and it should be tried at all times unless some cardiac complication forbids it. It may disorder the stomach, and should, like the bromides, always be given well diluted and after meals.

Antipyrine has been recommended by Lemoine in certain forms of epilepsy, but it has been condemned by other clinicians. He found it very useful in cases associated with migraine. In these cases the results were better than with the bromides, but in the idiopathic simple varieties it was useless. Mairet and Combemale have used the drug in epileptiform mania with satisfactory results.

In the epilepsy of childhood Solanum Carolinense in the form of the fluidextract, in the dose of 2 to 15 minims (0.1–1.0 cc.), is sometimes a useful drug.

A very important point, which is constantly brought before the physician who is treating epilepsy, is that of diet. Nearly every patient who suffers from this disease inquires what he shall eat. Few researches of a thorough character have been carried out on a large scale to determine what may or may not be ingested. Curiously enough, the influence of diet in one research covering a number of cases of chronic epilepsy seemed to be of little moment. Thus, Merson examined 24 such cases, putting 12 of them on a purely vegetable, and 12 on a purely nitrogenous, diet. The result, after this study had been continued for two months, was that the vegetarians had had a few less fits than the others, but the diffreence was so slight as to be of almost no weight in determining the question. On the other hand it has been claimed that a very low carbohydrate diet by causing an approach to ketonosis may be useful. The view that meats in moderate amounts are harmful is erroneous.

It having been shown by numerous investigators that many epileptics have an excess of cerebrospinal fluid in the subarachnoid spaces Fay has urged dehydration as a method of relief. He reports such a plan as having a notable effect in decreasing the number of attacks in major epilepsy, although it does not modify petit mal. The patient is first freely purged by magnesium sulphate for three days and after this his daily total fluid intake is cut down to from 10 to 20 ounces, not more. Fay claims that thirst is not suffered after a short time and the relief the patient receives makes him willing to withstand the inconvenience. The thirst can be modified to some extent by excluding the addition, by the patient, of salt to his food.

EPISCLERITIS.

Episcleritis occurs in the form of reddish, sometimes violaceous, subconjunctival swellings, nodes or patches, which usually appear in the ciliary region on the temporal side, though they may develop in any portion of the zone. To severe types of this disease, in the form of diffuse, bluish-red injection, often associated with crescentic areas of infiltration in the cornea and involvement of the iris and ciliary body, the term *scleritis* is applied. These lesions appear to be due to gout, tuberculosis, menstrual derangements, enterogenous auto-intoxication and focal infections in the buccal mucous membrane, sinuses and tonsils; rarely to syphilis. Hence the treatment requires ample general and local examination in order to discover and eliminate the cause. Internally the salicylates, aspirin and sometimes mercury and the iodides are useful, the medicinal and dietetic treatment being determined by the etiologic factor. Locally, atropine mydriasis is important, especially in the severe types, and hot compresses and dionin (5 per cent) to relieve pain. Occasionally, eserine sulphate and pilocarpine hydrochloride (¼–½ grain [0.0162–0.324 gm.]) to the ounce (30 cc.) are required, if iritis is not a complicating feature and there is a tendency to rise of intra-ocular pressure. In the presence of a tuberculous taint injections of *tuberculin* are of service. In chronic types massage with the yellow oxide of mercury ointment (gr. j–ʒj) is indicated and scarification or cauterization of the nodes have been recommended. Subconjunctival injections of physiological salt solution are occasionally useful.

Episcleritis and scleritis are prone to relapse and the danger of involvement of the cornea and uveal tract is always present; hence the need of thorough study of all conditions, local and general.

EPISTAXIS.

Nose-bleed depends upon many causes, the chief of which are traumatisms, plethora, and the presence of ulcerations in the nasal chambers. It also occurs as one of the prodromata of typhoid fever and in some cases of cardiac valvular disease.

The loss of blood takes place usually from a point on the septum ½ inch back of its anterior edge and about ¼ inch above the floor of the nose. Less commonly it arises from the septum just opposite the anterior lip of the middle turbinate or the anterior lip of the lower turbinate. Very rarely it may arise in the ethmoid region. Spray or apply a 1 to 1000 solution of adrenalin with about 4 grains to 1 ounce of cocaine. This tends to check hemorrhage, cleans the area for inspection and prevents pain. Next press a cotton applicator lightly dipped in pure carbolic acid against the bleeding spot or use a 50 per cent solution of silver nitrate. If all these measures fail, pack the nose with gauze dipped in liquid petrolatum.

The oil permits the withdrawal of the gauze the next day without tearing off the clot. In other cases insert a rubber finger cot after oiling it and pack it with cotton.

If the individual is full-blooded and strong full doses of tincture of aconite or veratrum are useful, say 5 to 10 minims (0.3–0.6) of one of them, followed in one-half hour by a smaller dose, if necessary. The value of these drugs depends upon their power of lowering blood-pressure, and in consequence decreasing the leakage from the break in the wall of the bloodvessel. Hemostatic serum, applied locally, may do good, but its chief use is in cases in which the blood lacks the necessary elements to cause coagulation. If this does not control the hemorrhage compress the facial artery of the same side as the bleeding nostril upon the superior maxilla near the nose, thus decreasing the blood supply. The head must be kept raised, and the patient must not bend over a basin or wear a tight collar.

A piece of bacon fat cut to fit and placed in the nostril may stop epistaxis which has resisted other measures.

Sometimes, if the patient raises one or both hands high above the head, the hemorrhage ceases. This is due to the fact that the easiest pathway for most of the blood is straight up the brachial arteries rather than through the tortuous vessels of the face. A hot foot-bath, by dilating the veins of the lower extremities, draws away the blood from the face and is a useful measure; but if bleeding has been profuse, this may cause the patient to faint unless he lies down when his feet are in the water. In other cases a hot-water bag applied over the dorsal vertebræ is efficacious, and sometimes cold when so used is of service. A piece of ice pressed against the nose may prevent further hemorrhage by causing localized anemia.

ERYSIPELAS.

This disease is now generally recognized as dependent for its existence upon the streptococcus of erysipelas, and the disease is at first a distinctly local one. The changes which have taken place in its treatment are chiefly the local measures, while those methods which have been used internally for many years have undergone no alteration. (See Antierysipelatus Serum, Part III Important.)

In a large proportion of cases erysipelas develops because the vital resistance of the patient has been lowered by some acute illness or by a chronic malady like nephritis or diabetes. For this reason its spread in the skin and the toxemia it causes must be controlled by the employment of measures which will enable the patient to combat infection. Rest in bed is essential and supporting treatment is demanded.

The internal treatment of erysipelas *par excellence* is the plentiful use of the tincture of the chloride of iron—20 to 30 minims (1.3–2.0), or even 40 minims (2.6), well diluted, four times a day. The diet should be regulated and the bowels kept in good order. Any excessive febrile movement is to be treated by the use of cool sponging with friction. If the patient passes into a typhoid state supportive measures must be used and alcoholic stimulants added to the food, which should be predigested or prepared so as to be readily absorbed.

The local treatment of erysipelas is very various, but in the majority of cases resort need be had to but one method. By far the best dressing for the majority of cases of erysipelas is one which the author has tried in a great number of instances with success. The skin of the part involved is carefully cleansed with Castile soap of the purest form, and then it is washed off with a 1 to 1000 solution of bichloride of mercury. The skin is dried with a soft towel, and a *thick coating* of ichthyol with lanolin applied, the strength of this ointment being half and half. Over this is placed antiseptic gauze also smeared with the ointment, and adhesive strips or a bandage used to keep the dressing in place. Sometimes the ointment alone may be applied if the area is small. Under this treatment the results are often extraordinary in all stages of the malady. Where ichthyol is not obtainable a saturated solution of magnesium sulphate gives good results if frequently renewed, or a thick coat of white-lead paint, as it is sold in cans before it is mixed with any thinning substance, will be found of service in an emergency.

The iron and ichthyol method is that always followed by the author. (See also Magnesium Sulphate, Part II and Antitoxin, Part III.)

The plan recommended by Higginbottom, of applying nitrate of silver, is sometimes successful. It consists in the use of a solution of the strength of 80 grains to 4 drams (5.3–16.0) of distilled water, which is thoroughly applied with a camel's-hair brush over the entire inflamed area and for a little space beyond. The application must be made twice or thrice to secure a good coating. This treatment will often arrest the inflammation and prevent its spread, but has caused sloughing; the author has never used it.

EXHAUSTION AND DEPRESSION.

While the treatment of both these conditions is almost identical in some respects, it is nevertheless important that a clear idea of the difference between the two be clearly understood, if for no other reason than that the physician may recognize that exhaustion is a far more serious state than depression. It also requires more careful treatment. The man who is depressed retains in his body all the vital energy necessary for the maintenance of life, but it is temporarily in abeyance from some cause. As soon as the incubus is taken away the system at once asserts itself and recovery takes place. This is not the case with a man suffering from exhaustion.

In this patient his strength is sapped and lost. The man depressed is the giant lying unconscious from a blow on the head; the man exhausted is the same giant after a long attack of typhoid or other fever of a similar nature. The treatment of depression is stimulation; of exhaustion, not only stimulation, but rest, feeding, and protection from exposure.

EXOPHTHALMIC GOITER.

The measure which is first in importance in all cases is *rest* in bed in a quiet room with relief from all cares and responsibilities, because the condition is characterized by great increase in metabolism. In certain patients it will be found that infected tonsils have some degree of etiological significance and they should be removed unless the patient is severely ill. So, too, infected teeth should be extracted. A regular rest cure should be undertaken. The use of nervous sedatives, such as the bromides or barbital to produce sleep may be resorted to as symptomatic remedies. The diet should consist largely of milk, fats and starches with very moderate amounts of meat, as much protein food is thought to stimulate the thyroid gland. This is essential because the high rate of metabolism will cause the patient to emaciate. Even if she is taking the equivalent of 3000 Calories she may be using 4000 or 5000 Calories. It is well to store the liver and muscles with glycogen before operative procedures as glucose is burned up twice as fast as is normal. Plenty of water is also essential because of the rapid oxidation processes and the free sweating often present. This matter of full feeding and water is especially important in those patients who have gastro-intestinal outbreaks characterized by severe vomiting and diarrhea. Rest should be continued for several weeks and followed by partial rest for some weeks. Rest may therefore be considered as a method toward cure, and in well-developed cases as a great help in those patients who are to be treated either by the roentgen-rays or radium, which agents are sometimes tried before resort to surgery. One or both give excellent results in many cases. As pointed out in the articles on Iodide of Potassium and Iodine (Part II), Lugol's solution is useful in this disease, and in full doses has extraordinarily good effects to combat its gastro-intestinal crises when they occur, but it is to be borne in mind that iodine is not a cure but a means of temporary relief or to prepare the patient for operation. Indeed its continued use may be harmful.

In the preparation of such a patient for operation the use of iodine is very useful. Its effect should be governed by use of the metabolimeter. It is noteworthy that some persons believe the differentiation between exophthalmic goiter and the adenomatous type is artificial. In both types, however, Lugol's solution is useful as a preparatory treatment to operation. In exophthalmic goiter the enlargement of the gland takes place between fifteen and thirty-five years, and systemic symptoms develop within three years. Adenomatous goiter develops from thirty-five to forty-five years, and the signs of intoxication do not develop in many cases for seventeen years. In the first type the metabolic rate is often above 50+, whereas in the adenomatous case it is rarely above 50+. If adenomatous goiter is present surgery offers the best remedy, but rest as a preliminary measure is advocated. The metabolic rate is always to be carefully estimated. A great many surgical measures have been tried—usually tying the arteries supplying the gland or partial thyroidectomy is done. Even when surgical measures are to be followed it is essential that a period of rest in bed shall precede interference and if cardiac feebleness is present, especially in the presence of auricular fibrillation, tonic doses of digitalis should be given. The profession is learning more and more that the use of drugs in hyperthyroidism is only to prepare the patient for the surgeon. Thus Lahey has reported a mortality-rate of only 0.28 per cent in 1068 patients.

EYE-STRAIN.

Eye-strain in the broadest acceptation of the term, is the name applied to those symptoms which may be caused by the presence of refractive error, or imbalance of the ocular muscles. While all varieties of ametropia may cause eye-strain, hyperopia and astigmatism are most potent in this respect. Fully 75 per cent of functional headaches are caused by refractive errors and defects of exterior ocular muscle balance; and these headaches may vary from a moderate frontal distress, to violent explosions of pain, and may be situated in any portion of the cranium. Moreover, they may be entirely unassociated with any pain in the eyes or any apparent disturbance of vision, and are frequently caused by low degrees of refractive error; in fact, they are perhaps more frequently caused by them than by the higher defects. It is doubtful whether *true migraine* is ever solely due to eye-strain, but as part of the treatment of this disorder correction of refractive error and muscle balance is of paramount importance. In addition to headache, eye-strain may cause pain in the back, especially between the shoulder-blades and at the root of the neck, precordial pain, vertigo, drowsiness, insomnia, habit-chorea, choreiform movements, convulsive seizures, melancholia, neurasthenia, palpitation of the heart, syncope, night-terrors, stomachic disturbances, vomiting, constipation, flatulent dyspepsia, "car sickness" and a variety of general or so-called reflex neuroses. The existence of any of these symptoms or affections should direct the attention of the attending physician to the condition of the eyes, and refractive error and muscular imbalance should be corrected. Certain cases of so-called spinal curvature, head tilting, head nodding and torticollis, in young persons are due to the influence of ametropia and impaired muscle balance. Children's eyes should be carefully tested before they begin school work and defective vision corrected. In this way the development of myopia can often be checked, and the evils of the effect of eye-strain, both local and general, prevented. The correction of refractive errors should be entrusted to properly trained physicians, that is, to ophthalmologists.

FEET SWOLLEN, TENDER, OR SWEATING.

These comparatively simple yet annoying conditions are often brought before the physician for relief, and patients suffering from them will frequently be more grateful for skilful treatment than in the event of recovery from a severe illness.

Swelling of the feet occurs chiefly in two classes of cases, excepting, of course, dropsy. The two classes named are old persons taking too little or too much exercise, and who may have gouty or rheumatic tendencies, and those who by constant standing or walking cause congestion of the lower extremities, chiefly by fatigue, or by wearing ill-fitting shoes, or by running over uneven ground, causing bruising. Where the swelling takes place in the first class, small doses of arsenic trioxide, $\frac{1}{60}$ to $\frac{1}{40}$ grain (0.001–0.0015), often do good, and careful examination should be made of the circulatory, renal and respiratory apparatus to discover any weak points, such as vascular relaxation or tendencies to varicosities. In all cases the presence of flat-foot or other structural weakness should be carefully investigated. In some cases absolute rest of the feet will be necessary before a cure is reached.

Where the feet are tender a common cause is bruising from too thin soles on the shoes, too tight shoes, and from abrasions or skin disease. More commonly than all they become sore from excessive sweating and resulting maceration. In some instances the pain is due to a broken-down instep. The pain is often treated as rheumatism.

The treatment of sweating and tender feet is, of course, the removal of the cause and the use of remedies designed to toughen and harden the skin of the parts. Probably the best application for this purpose is a solution of salicylic acid and borax, half and half, in water and glycerin, rubbed over the feet night and morning. If the sweating is very profuse, clean stockings should be worn each day, the stockings being previously soaked in a strong solution of borax and dried. The following prescription affords a useful powder:

℞—Pulveris acidi salicylici . . . . . . gr. xx vel xl (1.3-26)
Pulveris acidi borici . . . . ʒij (8.0)
Pulveris amyli . . . . . q. s. ad ℥j (30.0).—M.

S.—To be dusted over the feet night and morning, after washing and thoroughly drying them.

One of the most efficient applications is a solution of formaldehyde of such strength that 1 part of the commercial 37 per cent solution is mixed with 4 parts of water. Even this may be too strong in some cases.

Sometimes the use of cotton instead of woollen stockings may aid in the cure.

FEVER AND ITS TREATMENT.

(For the Treatment of each Fever, see its Title.)

The rule of practice should be to control all fevers that need control by the use of cold sponging or bathing and to resort to antipyretic drugs as little as possible. (See Cold, Part III.)

Asthenic Fevers.

(Fevers of a Typhoid Type.)

In the opinion of the author antipyretics should not be employed in the reduction of the pyrexia of the typhoid state, our main reliance being upon cold applications. They ought never to be combined with the cold bath, as they prevent the one thing we seek in the use of the cold, namely, reaction. Aside from the fact that the author has found such an opinion well founded in a large number of cases, logical reasoning endorses its correctness. Even if antipyretics were perfectly innocuous, their constant use in fever would but give the already overstrained kidneys the task of their excretion, while the stomach, already disturbed by necessary medicines and illness, has enough to do without the addition of another load. Further than this, we know that these drugs are not perfectly harmless, and we also know that they decrease oxidation, which is not the case with the cold bath, which increases it. The writer reiterates that in typhoid and other low fevers of the continued type antipyretics should not be given. (For Brand's treatment, see Cold, Part III, and Typhoid Fever, Part IV.) Fever will sometimes resist all doses of antipyretics we can give or all that is it safe to give, but no fever can completely resist the cold sponge when properly used, for by its use we produce beneficial results by reaction even if an actual fall of temperature does not take place. In septic fever and in tuberculosis antipyretics are harmful owing to the depression and the increased sweating which is apt to be produced, and cold bathing is not useful because the patient does not react.

Sthenic Fevers.

The application of antipyretic drugs to the febrile temperatures occurring in sthenic cases is not so irrational as their employment in a prolonged low fever of the adynamic type, but the wise physician will always endeavor to avoid their use if possible. Fever is not, as a rule, a very harmful process unless it is continued for a long period or is exceptionally high. Indeed it may even be beneficial. Antipyretic drugs decrease oxidation, probably interfere with ordinary protective natural efforts against disease, and place upon the eliminating organs the task of excretion. In acute illnesses, if the use of cold is impossible, these remedies may be given, but usually it is unnecessary to employ them, for unless the fever is long continued it is not harmful in itself. In scarlet fever the use of such drugs should be avoided, because the kidneys are in danger.

If in any case it is decided to give antipyretic drugs, they should never be pushed to the point at which even moderate cyanosis develops; and if they do not control the fever in moderate dose, they should be discarded and cold bathing insisted upon. The use of antipyretic drugs and cold sponging simultaneously is absolutely harmful.

Personally the writer never under any circumstances employs antipyretic drugs for the reduction of fever.

In thermic fever, or sunstroke, the employment of antipyretics is often useless. The excessively rapid upward rise of the temperature responds in no way to drugs, and there are many cases on record in which the use of antipyrine has utterly failed of good result.

FRECKLES AND CHLOASMA.

The removal of freckles is readily accomplished, but their return is inevitable if any exposure to the sun or wind occurs. One of the best applications for their removal is a solution of corrosive sublimate, in water, varying in strength from 1 to 4 grains to the ounce (0.06–0.25:30.0), and applied night and morning until the skin shows that it is irritated, when the lotion must be stopped for some days, after which its use may be begun again. A very efficient and much less poisonous remedy to leave about the room is a saturated solution of boric acid in water, applied in the same manner as is the solution of bichloride of mercury.

Another remedy is lactic acid, 10 grains to 1 dram (0.6 to 4.0) of water, used in the same manner as the solution of the bichloride of mercury. The following prescription is recommended by Unna:

℞—Bismuthi oxidi,		
Pulveris amyli	āā	gr. xxx (2.0)
Kaolini		ʒj (4.0)
Glycerini		fʒij (8.0)
Aquæ rosæ	q. s. ad	f℥ij (60.0).—M.

S.—Paint on spots and allow to dry, washing the drug off before each new application.

Or the following may be used:

℞—Zinci oxidi	gr. iij (0.2)
Hydrargyri ammoniati	gr. iss (0.08)
Olei theobromatis	fʒiiss (10.0)
Olei ricini	fʒiiss (10.0)
Essentiæ rosæ	gtt. x (0.6).—M.

S.—Apply night and morning.

GASTRIC CATARRH (ACUTE).

By far the most important point in the treatment of acute gastric catarrh is the regulation of the diet. The dietetics may be divided into two parts—first, the regulation of the food during the attack or during convalescence; and, secondly, the character of the food to be used during the interval following one attack and preceding the next. Total abstinence from food in the acute stages of the attack, and absolute gastric, bodily and mental quietude, are advisable. There are several reasons for this. In the first place, the juices of the stomach are in an abnormal state and unfit to act properly if the stomach receives more food. Secondly, the mucous membrane of the stomach is already hyperemic from the inflammation, and, as the normal viscus becomes physiologically hyperemic on the ingestion of food, we would add to the congestion of the bloodvessels did we allow more nourishment to enter the stomach. Last of all, the excess of the mucus and lactic and butyric acids present renders any new food impure before it can be assimilated, and so prolongs the trouble. As the attack passes off small amounts of food may be given, which should be of a kind readily digested and not likely to become easily decomposed or rendered acrid. Milk with a large percentage of lime-water or citrate of sodium is to be used to prevent a too firm coagulation and to decrease the secretion and acid reaction of the mucus. The thirst is often excessive, although anorexia is complete, and small pieces of ice may be administered for its relief. Small doses of bismuth subnitrate (grains 2 [0.12]) or milk of bismuth every two hours are advisable for children.

Commonly it will be found that the patient rapidly improves up to a certain point, then stops improving or relapses. This is sometimes due to an accumulation of mucus, which when mixed with food causes it to undergo fermentation. If marked evidences of the presence of this secretion are given, a mild and gently acting purge, such as milk of magnesia, followed by a little orange-juice, may be employed. In other instances the relapses depend upon a tendency to a condition of atony, which can only be overcome by prolonged and careful treatment adapted to the improvement of the general health. Sodium bicarbonate with compound infusion, or compound tincture, of gentian may be used during convalescence, and small sips of effervescing draughts are useful. If constipation exists and vomiting forbids the use of the ordinary purgatives, a Seidlitz powder divided into fourths or fifths, and taken in this way every fifteen minutes or one-half hour, will settle the stomach, move the bowels, and often carry away mucus.

If there is much epigastric distress, a spice or mustard poultice is often of service.

Sweets and starches are to be rigidly denied the patient. If anemia exists, iron may be used, but this is rarely needed.

The abdomen should be carefully protected with flannel, and draughts and unsanitary surroundings avoided.

GASTRIC CATARRH (CHRONIC).

Chronic gastric catarrh is a condition of the stomach commonly seen in a more or less well-developed form. It is often associated with much indigestion and the eructation of sour liquids, or even with active vomiting. The secretions of the stomach are nearly always abnormal, and fermentative changes are constantly present in the gastric contents. Lavage is almost always to be resorted to for its relief. This is best done in the morning before breakfast, and to the water used may be added ½ dram (2.0) of hydrogen peroxide to the pint to dislodge the mucus covering of the gastric mucosa. If more H_2O_2 than ½ dram is added the mucus becomes so frothy as to obstruct the tube. (See Lavage, Part III.)

By far the best treatment for this condition is the use of counter-irritation over the epigastrium by repeated applications of tincture of iodine, the strict regulation of the diet, and the use, internally, of nitrate of silver and extract of hyoscyamus, before meals in pill. Often, however, the better remedy is oxide of magnesium. (See Magnesium, Part II.) Chloride of ammonium in 10-grain (0.65) doses is useful. For prescription see Bronchitis. In many instances the patient will be greatly benefited by the use of a Seidlitz powder or Carlsbad salt[1] in hot water before breakfast each morning, as this washes out the stomach, dissolves the mucus and unloads the mucous membrane of its congestion, at the same time overcoming any engorgement of the liver. Constipation is nearly always present, and should be relieved by appropriate drugs, such as the waters just named or cascara sagrada, of which the best preparation is the aromatic fluid-extract, rendered free from bitter taste, as in "cascara evacuant." An occasional blue mass purge is useful.

All fats, rich foods, strong meats, ham, bacon and fried foods are to be avoided, and only mild starch foods with taka-diastase resorted to if the case be an obstinate or severe one.

In cases in which the chronic inflammatory process has gone on to atrophy of the tubules the use of hydrochloric acid is often of great value. (For formula, see Hydrochloric Acid.)

GASTRIC DILATATION.

Acute dilatation of the stomach, as that following some bodily injury or an operation, is to be treated if possible by lavage with hot water. It should not be attempted if there is reason to believe that the gall-bladder, the duodenum, the stomach, or the appendix is seriously diseased as the retching may cause damage.

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[1] Artificial Carlsbad salt may be ordered, composed of 8 ounces of sodium phosphate, ½ ounce of sodium chloride, and 1 ounce of sodium carbonate. The dose varies from 2 drams to ½ ounce (8.0–16.0).

Chronic gastric dilatation is to be treated with two objects in view, namely, the relief of the symptoms and the correction of the gastric condition as far as possible. The relief of the symptoms depends upon the suitable regulation of the diet, the proper use of washing out the stomach (lavage), and the use of other remedial measures. All these efforts also tend to relieve or modify the underlying gastric state in that they remove certain influences which, if continued, would necessarily make the condition of the patient worse. The actual state of dilatation when once developed cannot be materially improved. In the way of diet, all articles bulky in character, such as cabbage, and those foods which are slow of digestion and capable of rapid fermentation should be excluded. Particularly is this true of rich or fatty foods, and of drinks such as beer and ale. When food is given, it is to be administered in small amounts and often, rather than in large, full meals, and it should consist chiefly of roasted and broiled meats, easily digested starches, such as "Zwieback" bread or "pulled bread," and the green vegetables, like lettuce, asparagus, string beans, and moderate amounts of spinach. To aid in the digestion of vegetable foods 5 to 10 grains (0.30–0.65) of taka-diastase should be taken with each meal, and to this may be added a little powdered capsicum to stimulate the stomach. Where gastric digestion is very faulty, predigested food and rectal alimentation should be employed for a time. In the way of direct treatment, the stomach of the patient should be washed out with the stomach-tube at least once a day; and if fermentation is active and food is apt to be retained in this organ, it should be thoroughly cleansed before each meal, and some mild antiseptic, like boric acid, used in the washing fluid. Lavage not only removes decomposing food and mucus, but also exercises a beneficial effect on the gastric walls. The water used should not be cold nor tepid, but hot, and may contain 1 dram (4.0) of boric acid to the pint (480 cc.). In the way of direct treatment by drugs, the physician should use full doses of dilute hydrochloric acid to aid digestion, say, 20 to 30 minims (1.3–2.0), and give strychnine in full doses to aid this function, and also to increase the motor power of the stomach, so that it will urge the food on into the bowel. Often the lavage and strychnine combined will produce great improvement. General hydrotherapy in the form of cold douches to the entire body, and exercise on horseback or on foot, are valuable in many cases. As the majority of cases are due to some obstructive lesion at the pylorus this possibility should be investigated and, if present, surgical relief sought. In many instances gastroptosis is marked; a supporting belt should be worn.

GASTRIC AND DUODENAL ULCER.

1. The treatment of gastric and duodenal ulcer consists in eliminating septic foci from the mouth, whereby one of the possible causes of the development of ulcer is removed.
2. We are to obtain the greatest degree of rest compatible with the patient's condition of life and to endeavor to put vital resistance, or regenerative power, at the highest point.
3. The stomach or duodenum, as the case may be, must be given as nearly as possible motor rest and secretive rest.
4. All irritating foods and drinks must be avoided.
5. Only bland carbohydrate foods with milk and cream are to be given for a long period.
6. The presence of any free hydrochloric acid in the stomach must be prevented by giving food so often that the acid secreted is never free, and by the frequent administration of alkali to guard against the presence of free acid.

The degree of physical rest of the patient differs in individual cases, but all do best if a starting period of at least two weeks in bed is insisted upon. During this time general nutrition may be maintained by massage and alcohol rubs and by the use of electricity, care being taken to keep away from the abdomen.

If the patient has been having much epigastric distress or pain or there is marked abdominal tenderness, this rest in bed is absolutely essential and may have to be maintained many weeks. The same rule holds true if there has been vomiting of blood or constant occult blood in the stools. In some of these cases it is best for the first few days, particular in bleeding cases, to use enemata of levulose, or normal saline, and to give alkalies by the mouth, without food, if need be, to correct acidity. (See Peritonitis, Part IV.)

The point to be borne in mind is that in an ordinary case no food should be given except that which causes a minimum of gastric movement and a minimum of gastric or duodenal secretion.

The following plan largely devised by Sippy may be followed with advantage. A mixture of equal parts of milk and cream, a total of 3 ounces, is taken every hour for the twelve daylight hours, and half way between each feeding 10 to 15 grains of calcined magnesia, with an equal amount of sodium bicarbonate, is given stirred up in $\frac{1}{2}$ glass of water. This method does not involve much trouble, because the food and the alkaline fluids may be kept in vacuum bottles, and the patient can measure the doses by the use of a graduate and keep time with a watch. If the magnesia causes diarrhea calcium carbonate in the same dose may be substituted for it. After a period of a few days, if the patient has no manifestations of gastric distress, an egg, boiled one minute, with a cracker, may be given in the forenoon and 3 ounces of cereal, cooked until very soft, given in the afternoon in addition to the 3-ounce feedings already mentioned. I have found the addition of taka-diastase to these carbohydrate feedings advantageous. After the last feeding in the evening the alkaline mixture should be taken every half hour for 5 or 6 doses, to prevent any acidity from developing. The length of time that rigid hourly feedings should be persisted in differs, of course, with each case, but gradually other foods, such as custards, cornstarch and jellies (if not acid) may be added, and the feedings cut down to every two, three or four hours, and finally to three times a day. The hourly use of the alkali should be continued for a long period. It is sometimes necessary to use a Rehfuss gastric tube and test the acidity to determine if the amount of alkali is sufficient to prevent the presence of free acid. Not sooner than four to six weeks are meats to be allowed. After six weeks the alkaline powders are stopped for a few days, and when this is done the presence of free acid should be prevented by frequent feedings.

Attention has been called to the fact that the administration of large doses of sodium bicarbonate over a long period of time may exercise a deleterious influence upon the general system. It has, therefore, been suggested that instead of using bicarbonate of sodium, carbonate of magnesium and calcium carbonate, we substitute for them dibasic and tribasic calcium phosphate and magnesium phosphate, using about 15 to 60 grains three times a day after meals. They possess the additional advantage that they are tasteless. They probably do not act as promptly as antacids as do the other salts which have been more commonly employed.

The increase in rations, both as to variety and amount, should be most gradual, the physician extending the dieting over six weeks to one year. Beef-tea and soups had better be avoided, as they will irritate the stomach. Tender chicken or game and minced lamb may be finally given. Cheese, coffee, tea, beer and ale are to be avoided, as are all very hot drinks. Fresh green vegetables may be used in moderation, but fresh bread and unripe fruit must be carefully avoided.

Lenhartz's treatment consists in absolute rest in bed for a month and in feeding the patient with small quantities of beaten-up eggs and milk, the quantities being increased day by day. An ice-bag is kept constantly applied to the epigastrium, and after the first week soft-boiled rice, minced meats and semi-solid and solid foods are gradually allowed.

The actual quantities of foods allowed by Lenhartz consist on the first day of from 7 to 10 ounces of milk with 1 egg, and the increase is 3½ ounces of milk each day and 1 egg each day until 1 quart of milk and 6 to 8 eggs are ingested. A sixth of these amounts are given every two hours. The amount of meat first given is 2 ounces. The bowels are not disturbed by treatment during the first week, but they are not prevented from moving naturally. If they do not move naturally an enema is given every fourth day during the rest of the treatment. Although the number of calories which the patient receives during the first few days is considerably below the number actually required for the maintenance of nutrition, the gradually increased quantities of food soon bring the calories up to about 3000 per day, which is fully as large as an individual in perfect health needs to ingest. He claims that the number of instances of hemorrhage are materially decreased by this method, as is also the percentage of relapses.

It will be noted that Lenhartz diet is distinctly protein in character. Smithies on the other hand advises a carbohydrate diet chiefly. He begins with nothing but water by the mouth for a few days accompanied by nutrient enemata of 50 per cent alcohol 1 ounce, glucose syrup 1 ounce, and normal salt solution 6 ounces four times daily by means of the Murphy drip adding 10 minims of laudanum if the bowel is irritable. After the first few days a thin gruel of any starch such as rice, cream of wheat, peas, cornstarch, etc., to the extent of 6 ounces is given six or eight times a day. These gruels may be flavored by chocolate, coffee or vanilla. He advises the chewing of gum before feeding, presumably to cause secretion of salivary and pancreatic juice. A better plan is to give taka-diastase with each feeding. After two or three weeks orange-juice is given in small amounts and 4 ounces of parboiled milk with equal parts of lime-water are allowed. The quantities are gradually increased week by week and later Brussels sprouts, asparagus, cauliflower or beans are allowed in addition being first passed through a strainer. Finally 1 or 2 poached eggs are added with zwieback followed by oysters, hamburger steak, and crackers. These measures are carried out rigidly for three months and the early diets resorted to at any sign of relapse. Care as to diet is essential for the rest of the patient's life. Every one of experience knows that very few patients will persist in these methods even if well enough off to give the time. Alvarez has well said that feedings with smooth carbohydrate liquids every three hours is about all that can be continued for several months. Even a workman can carry one or more thermos bottles well filled with food and partake frequently of their contents at regular intervals.

The drug treatment of these cases is palliative as to pain, and curative. For the pain, counterirritation of a more or less severe and constant type should be applied to the epigastrium, either as a spice-or mustard-plaster or by means of a hot-water bag. The counterirritation should be as continuous as possible. Sodium bicarbonate and the subnitrate or subcarbonate of bismuth are also of service in the dose of 20 grains (1.3) each, and to these may be added from $\frac{1}{20}$ to $\frac{1}{4}$ grain (0.003–0.015) of morphine sulphate, $\frac{1}{4}$ to $\frac{1}{2}$ grain (0.015–0.03) of dionin, or 1 grain (0.06) of codeine. These may be given thrice daily if necessary. Only the smallest dose of morphine necessary to relieve the pain should be employed.

A valuable treatment for the pain and for the acidity is the following pill:

℞—Argenti nitratis . . . . gr. iv (0.25)
Extracti hyoscyami . . . . gr. x vel xx (0.6–1.3).—M.
Fiant pilulæ, No. xx.
S.—One pill half to one hour before meals.

Another useful drug in such cases is chloretone in 5-grain (0.3) doses, given in capsule three times a day one-half hour before food. When great gastric acidity is present, which is not controlled by the diet or pill named above or by the use of chloretone, the following formula may be employed:

℞—Sodii bicarbonatis,
Magnesii oxidi ponderosi,
Calcii carbonatis . . . . āā ℥j (30.0)
Olei menthæ piperitæ . . . . ♏x (0.6).—M.
S.—A saltspoonful every two hours in a little water.

In a fairly large proportion of cases pain may be due to pyloric spasm in which cases large doses of extract of belladonna or extract of hyoscyamus are often very efficacious.

For the constipation which is frequently present the patient may receive a dose of Carlsbad salt or phosphate of sodium, or even the sulphate of magnesium before breakfast, although it is best, as a rule, to rely upon an enema each day to produce a movement.

For the relief of vomiting and of hematemesis absolute abstinence from food, so far as its administration by the mouth is concerned, is to be insisted upon for a period of several days. Nutrition must be maintained under such circumstances by feeding by the rectum with levulose. (See Part III.) If the vomiting is persistent, small doses of cocaine, $\frac{1}{4}$ grain (0.015), may be given, or cocaine and bismuth subnitrate combined. Sometimes 2- to 3-grain doses of acetanilid are useful, or phenol may be given in the same dose with 20 grains (1.3) of subnitrate of bismuth. If there is hematemesis good results may follow the use of 1 dram of the solution of adrenalin chloride, or of the solution of the subsulphate of iron (Monsel's solution) in the dose of 3 minims (0.2) in a little water every half-hour but gastric rest is better. Cold compresses or an ice-bag may also be applied to the epigastrium for the same purpose unless the hemorrhage is so profuse as to lower the patient's temperature.

The occurrence of hemorrhage severe enough to jeopardize life usually indicates operation to prevent recurrence, *but not until the patient has rallied, and in most instances not until the corpuscular and hemoglobin content of the blood are high enough to make surgery safe.* Surgery is indicated when the constant presence of occult blood in the stools, or repeated small hemorrhages, shows that the ulcer is leaking this fluid and if the hemoglobin is not below 50 per cent.

Should perforation of the stomach occur, operative interference is to be promptly resorted to after the shock has been treated by supportive treatment in the way of heat to the limbs and the hypodermic use of ether, brandy, and atropine. Morphine should also be given freely unless collapse is too pronounced, as it tends to diminish abdominal pain and shock.

In obstinate cases of ulcer with much pain and evidence of a severe lesion a surgeon of experience should perform gastro-enterostomy or gastro-jejunostomy, to permit healing of the ulcer, with or without excision, particularly if there has been repeated hemorrhage. The decision as to whether a physician or a surgeon should take charge of a case of gastric ulcer may be determined on the following facts:

When the symptoms are the ordinary ones of gastric distress or indigestion the case is medical. If there are signs of pyloric obstruction due to cicatricial deposit, as represented by retention-vomiting or dilatation, or hour-glass contraction, adhesions which interfere with function, or repeated hemorrhage, the case is surgical, the more so if there is a long history of gastric trouble. The possibility of a chronic ulcer ultimately becoming malignant is also to be borne in mind when an operation is considered, but this is not as likely in duodenal as gastric ulcer.

Two final points are to be borne in mind, viz.: Every case of ulcer should be told that medical cure is not a matter of days or even weeks but months or perhaps years. Weeks for the relief of distress and ability to take food, and years, if cure, in the sense that dietary restrictions can be ignored. The second point is that operation is not always curative entirely apart from its immediate danger. If prolonged dietetic and medical treatment are really impossible operation is, of course, justified.

GASTRO-ENTERITIS.

Gastro-enteritis is a condition of inflammation affecting the entire alimentary canal in some instances, and commonly produced by the ingestion of some irritant substance, either in the form of bad food, poisons, or mechanical irritants, such as grape-seeds or cherry-stones. The symptoms accompanying it are exceedingly various, but consist chiefly in pain of a griping character, with watery or mucous stools, or, if the inflammation be very severe, absolute and unyielding constipation may be present. The nervous symptoms depend upon the degree of irritation and the general nervous tendency of of the patient, and if the trouble is very severe, a condition of collapse may result.

If the irritation is very intense, exfoliation of the mucous membrane may take place, the epithelium coming away in shreds.

The treatment of gastro-enteritis depends upon its severity and cause. Almost always we first allay the pain and tendency to inflammation by the hypodermic use of morphine, and immediately follow this or precede it by an emetic of a non-irritating and rapidly acting type, such as apomorphine, provided there is reason to believe that the poison or food still remains in whole or in part in the stomach. If the irritant has been taken some time before the physician is called to see the case, emetics are contraindicated, as by disturbing the abdominal contents they increase the inflammation. If the irritant has passed the pylorus, castor oil, in the dose of 2 to 3 tablespoonfuls (30.0–45.0) to an adult, may be given to sweep out the offending materials and lubricate the intestinal walls. The sulphate of magnesium is of value, because, in addition to its purgative effect, it also depletes the inflamed bowel. Having got rid of all offending materials, opium is to be freely used to ally irritation and control diarrhea (see Diarrhea), and hot compresses are to be applied to belly, or a spice-or mustard-plaster used instead. (See article on Diarrhea.) Vomiting when excessive is to be treated in the manner described under that head. The after-treatment of acute gastro-enteritis is very important, both in respect to food and drugs. Predigested foods are, therefore, in many cases indispensable, and a carefully regulated diet is a *sine qua non*. The abdomen should be protected from cold by a flannel binder.

GLAUCOMA.

Glaucoma is a disease, the essential symptoms of which in its various manifestations depend upon increased intra-ocular tension. It appears in an acute, subacute or a chronic form. The affection in general terms is characterized by halos appearing about artificial lights; periods of obstruction of sight; shrinking of the nasal half of the field of vision; narrowing of the anterior chamber of the eye; anesthesia of the cornea; and increased tension of the eyeball. In the "glaucomatous attack," or acute glaucoma, the injection of the eyeball is intense; the lids swell, there is photophobia, the cornea is steamy, the pupil *dilated* and motionless, the tension of the eyeball is greatly raised and the globe cannot be dented by the palpating fingers and the vision is rapidly destroyed. The condition may be mistaken for iritis or acute conjunctivitis—a fatal blunder.

Acute glaucoma should be treated locally with myotics. Of these the best are eserine, in the form of the sulphate or the salicylate, in a strength of 1 to 4 grains to the ounce, or hydrochloride of pilocarpine in a strength of 2 to 5 grains to the ounce. One drop of such a solution should be instilled with sufficient frequency to contract the dilated pupil and to keep it in a state of contraction. The action of the myotic may be enhanced by the application of hot compresses and corneal analgesia established by the use of dionin in 5 per cent solution. *Atropine and all mydriatics are strictly contraindicated.* Internally full doses of salicylate of sodium should be administered. If the pain is very severe there is no objection to a hypodermic injection of morphine. The surgical treatment of acute glaucoma is usually promptly necessary, preferably a broad iridectomy, and this operation should be performed unless the myotics are speedily efficacious.

In so-called chronic glaucoma, in which there are no inflammatory or congestive symptoms, but in which there is a progressive atrophy of the optic nerve with cupping, associated with diminution of the light-sense and contraction, especially of the nasal field of vision, and the development of scotomas or dark areas in the central field (Bjerrum scotomas, etc.), and in which the diagnosis is made by means of the ophthalmoscope and a study of the visual field, myotics are useful, and should be employed in a strength not so great as that recommended for acute glaucoma, but with sufficient frequency to maintain a contracted pupil. The intra-ocular tension should be frequently tested with a tonometer. Should myotic action fail, or should the disease progress in spite of it, peripheral iridectomy or one of its substitutes may be employed, but the best surgical procedure is an operation which creates a filtering cicatrix; for example, Lagrange's combined iridectomy and sclerectomy, or Elliot's corneo-scleral trephining or iridotasis. The sooner operation is performed, the better the result, only too often the surgeon is tempted to defer operation until the progress of the disease has reached a stage when contractions of the field have come dangerously near the fixation point.

GONORRHEA.

Immediately after exposure the gonococci lie upon the mucosal surface and may be removed by mechanical means or perhaps destroyed by germicidal application. In a few hours (four to eight) they have penetrated beneath the superficial epithelial layer, and their prompt eradication or destruction has become difficult and uncertain.

The Prevention of Gonorrhea.—Immediately following exposure, urination, momentarily interrupted several times by closing the meatus with the finger, a thorough washing of the glans penis and prepuce with soap and water, and an instillation of 20 drops of a 5 per cent freshly prepared neosilvol solution or 1 to 3000 potassium permanganate into the open lips of the meatus, by means of an eye-dropper, will usually prevent the development of gonorrhea even though gonococci have been deposited on the meatal surface. (See Silvol and Neosilvol, Part II.)

The Abortion of Gonorrhea.—When the symptoms of infection have developed, providing treatment be instituted before there has been deep penetration by the gonococci, destruction and elimination of the infection is still possible. When a patient presents himself within a few days of exposure with a slight discharge, made up in the main of mucus and squamous epithelium and showing gonococci, he is given a 3-ounce bottle of a 10 to 20 per cent solution of neo silvol (freshly prepared), and is directed to inject by means of a cone-nozzled urethral syringe the first 3 inches of his urethra two to four times a day, urinating first in each instance and dropping a few drops into the open lips of the meatus before making the injection. The injection is confined to the meatal 3 inches by pressing the penis at or behind the peno-scrotal juncture between the little and ring fingers of the holding hand. The gonococci usually disappear in the first twenty-four hours. After five days, even in the absence of gonococci, there may persist a slight mucopurulent discharge.

The Systematic Treatment of Gonorrhea.—When the patient presents himself with a frankly purulent discharge teeming with gonococci the treatment may be general or local—a combination gives the best results.

General Treatment.—This, always indicated, has for its end:

1. The best obtainable condition of general health, since cure, though helped by medicaments, is dependent on tissue resistance.

2. An unirritating condition of the urine. This implies bodily quiet, perfect digestion, regular evacuations from the bowels, and a urine reaction neither strongly acid nor the reverse.

3. The avoidance of local congestion. Constipation, sexual excitement, bodily fatigue, alcohol, and surface chilling are the common factors which produce local congestion.

4. Free diuresis. Water drinking short of the extent which would interfere with gastric digestion. Milk or buttermilk diet.

5. Drugs which in their elimination render the urine antiseptic. These must be given with caution, and never to the extent of lessening the appetite or irritating the kidneys. Salol, methenamine, phenyl salicylate—these properly used are distinctly helpful. An excellent formula for the administration of balsam in the late stages is the following:

℞—Olei santali	gr. v (0.3)
Balsami copaibæ	♏v (0.3)
Olei cinnamomi	♏j (0.06).—M.

Pone in capsulam No. i.

S.—These capsules should be taken beginning with one every two hours, followed by a glass of water. From six to twelve being administered a day.

These capsules should be stopped if they cause stomach disturbance, bicarbonate of soda, in 5-grain doses, being substituted for them.

Internal treatment is never to be depended upon entirely. It is merely an aid.

Local Treatment.—An infected urethra may be treated either by irrigation or injection. The irrigation may be accomplished by a fountain syringe and either a short nozzle or a catheter, or by a large piston syringe and a catheter.

Irrigation.—The choice of lotion is of minor importance. The familiarity of the surgeon with the degree of inflammatory reaction he may fairly expect from the lotion of his choice is of major importance.

A satisfactory treatment consists in thoroughly and repeatedly flushing the urethra with permanganate lotion. This may be accomplished by means of a fountain syringe and a blunt, flattened, conical nozzle of such size that when its extremity is passed into the meatus it will fit so well that gentle pressure upon the nozzle will prevent regurgitation of fluid. The bag is filled with hot permanganate solution, 1 to 6000, and is elevated 2 feet above the level of the bladder. After first thoroughly washing the glans and lips of the meatus, the nozzle should be inserted and held firmly in place until the entire anterior urethra is distended, when the nozzle should be slightly withdrawn and the urethral contents allowed to escape. After this has been repeated several times the nozzle is held firmly in place until 3 or 4 ounces of solution have passed into the bladder. This treatment should be repeated night and morning for at least a week, the strength of the permanganate solution being gradually increased up to 1 to 2000, if undue irritation is not caused by such increase. If at the end of a week no gonococci can be found the irrigations should be continued once daily for four days. When gonococci persist the irrigations should be continued for two or three weeks.

Injections.—When this method of irrigation cannot be practised, a syringe with a conical nozzle and with a capacity of at least 1 ounce may be employed; this should be used two to six times a day, 2 syringefuls of the dilute lotion being injected immediately after urination. The liquid should be forced in very gently, being allowed to flow out by slightly lessening the pressure of the nozzle upon the meatus when the anterior urethra is full. When large injections are attempted by the ordinary small urethral syringe, the frequent application of the latter to the meatus occasions much irritation. It is desirable that the injections should pass back into the posterior urethra, since this portion of the canal is usually involved in acute inflammation.

A hyperintense reaction, as evidenced by marked swelling and increase in pain and ardor urinæ, indicates lessening the strength of medication and the frequency of application.

Here again silvol or neosilvol (see Part II) may be used.

When injections are intensely painful, or their use, following the immediate discomfort, is not attended by a local feeling of betterment in acute cases, they are probably doing more harm than good. This point is determined by withdrawing them for a day or two, or substituting for the medicament hot normal salt solution.

When the gonorrhea has already assumed a markedly inflammatory type, with swelling and edema of the penis, redness and eversion of the meatus, and great sensitiveness of the urethra, local treatment other than wrapping the penis in gauze kept wet with dilute alcohol and lead-water, should be omitted. With the subsidence of acute inflammatory symptoms and the appearance of copious discharge the injection treatment may be inaugurated. It must be remembered that injections may in themselves prevent the discharge from entirely disappearing. Hence, as the symptoms ameliorate the injection should be made less frequently, finally being entirely omitted for some days if the discharge seems to continue longer than usual.

Obstinate chordee may require bromide of potassium and chloral. Of these 1 dram of the former must be given at bedtime, and 10 grains (0.6) of the latter; this may be repeated in the night if painful erections persist. Opium or belladonna suppositories, or hypodermic injections of morphine, gr. $\frac{1}{4}$ (0.015), and atropine, gr. $\frac{1}{60}$ (0.001), will prove satisfactory. The patient should be instructed to take a prolonged hot bath before going to bed, and to rise during the night to pass water.

Ardor urinæ is usually relieved by the use of demulcent drinks and by the employment of bicarbonate of sodium or citrate of potassium in sufficient doses to render the urine but slightly alkaline. Either of these drugs is conveniently carried in the form of compressed tablets, taken one or two hours after meals in 10-grain (0.6) doses with plenty of water. The instillation into the urethra, by means of an eye-dropper, of a 4 per cent solution of procaine a few minutes before urination markedly diminishes the burning. Finally, this symptom may often be relieved by instructing the patient to pass water with the penis submerged in a vessel containing hot water.

Where the inflammation is of a high grade and attended by fever and general malaise, rest in bed, milk diet, and the administration of 10 minims (0.65) of tincture of aconite, repeated every two or three hours, is followed by marked relief.

The distressing symptoms of acute posterior urethritis do not usually develop until the disease of the penile portion of the urethra has run a course of two or three weeks. During the very acute symptoms local treatment applied to any portion of the urethral canal probably aggravates the condition, and even the internal administration of balsams and antiseptics must be employed with very great caution if at all. Hence, when in the third week of gonorrhea frequent urgent and painful micturition indicates an acute exacerbation of posterior urethritis, *suspension of all active treatment is indicated*. The bowels are kept open; the diet is carefully regulated; the urine is rendered bland, unirritating, and antiseptic; repeated warm baths are ordered, the painful symptoms being controlled by opium and belladonna. When the acute symptoms subside, the quantity of antiseptics taken by the mouth may be increased, balsams may be added, and local treatment may be given by means of the gravity-bag and short conical meatus nozzle using a 1 to 5000 potassium permanganate solution under light pressure until the bladder is filled when it is voided. This should be done daily.

The use of the instillator is indicated when total flushings are unavailing.

The patient is first instructed to empty the bladder of a portion of its contents; by this means the urethra is flushed out. The anterior urethra is then irrigated by means of the bag and short nozzle, after which an instillator very gently passed until its tip has entered the membranous urethra. From 10 to 20 drops of the solution of choice are then injected, and in their backward flow bathe the entire membranous and prostatic urethras. Protargol, 0.5 per cent, or silver nitrate, 0.1 per cent, are the medicaments of choice. The treatment should be repeated every third day, and should be preceded by gentle prostatic massage. Instillation may also be given through a catheter passed until its eye reaches the prostatic part of the urethra. By means of a syringe the injection of choice then can be driven in. This fluid enters the bladder, and is passed with the urine at the next act of micturition.

Chronic Gonorrhea.

Chronic gonorrhea is characterized by a persistance of purulent or muco-purulent gonococci-containing discharge for more than six to ten weeks. It differs from the acute form in the fact that the inflammation is distinctly localized in certain portions of the urethra, and does not invade the whole canal with uniform intensity; hence, efficient treatment must be directed not to the whole urethra, but to the diseased areas. Foci of chronic urethritis are usually found either in the bulbous portion of the urethra or in the membranous or prostatic portion.

If the disease is located in the anterior urethra it will commonly be found to depend upon the existence of a stricture of large caliber. The passage of sounds of full size—cutting the meatus if this is necessary for their introduction—will be followed by prompt relief in such cases. The sounds should be used not more frequently than twice a week, and should be preceded by mild antiseptic irrigation, best effected by the gravity-bag and short urethral nozzle, irrigating daily with silvol or neosilvol (10 to 20 per cent), argyrol, silver nitrate (1 to 5000), metaphen (1 to 2000), or potassium permanganate (1 to 2000 to 1 to 500). When the general catarrhal condition is materially modified, by means of an ordinary urethroscope, the focus of inflammation may be exposed, and may be treated directly by strong astringent solutions carried in by means of a brush or by absorbent cotton secured to the extremity of a long applicator. Nitrate of silver or sulphate of copper, 20 grains to the ounce (1.3–30.00), may be employed.

Chronic posterior urethritis must be treated by remedies applied directly to the diseased area. The silver salts are more commonly successful than any other medication. By means of Ultzmann's instillator 5 to 10 minims (0.3–0.6) of a solution, varying in strength from 5 per cent to 10 per cent freshly prepared silvol, may be employed. Irrigations are also serviceable; but previous to their employment the prostatic follicles should be emptied of their purulent contents by massage through the rectum.

It must be borne in mind that chronic gonorrhea is commonly due to unskilful or not sufficiently prolonged treatment of the acute stages. Not only should the treatment of acute gonorrhea be continued until the gonococci have entirely vanished, but for fully two weeks after the disappearance of all symptoms of inflammation. The same rule holds good in regard to the chronic manifestations of the disease.

Per contra, it must not be forgotten that long-continued irritant treatment may in itself indefinitely prolong a urethral discharge.

There is a mucous secretion which quite frequently follows a gonorrhea, but which is in no way dependent upon the persistence of this disease. Microscopic examination will at once determine its nature. It is probably most rapidly cured by attention to general hygiene and by tonic and supporting treatment.

A urethritis due to the Micrococcus catarrhalis which exhibit the staining reactions of the gonococcus and can be distinguished from the latter only by cultural studies, differs from gonorrhea only in the comparative mildness and brevity of the untreated course. It recovers in from two to four weeks without treatment and almost as quickly if treated not too vigorously.

Complications of Gonorrhea.

Balanitis and *balanoposthitis* are treated by perfect cleanliness. The discharge must be thoroughly washed out, and the surface must be dried and isolated. The thorough cleansing of the parts is best accomplished by weak astringent solutions, such as the chloride of zinc, 4 grains to the ounce (0.25–30.0), 1 per cent boric acid, or 1.5 per cent phenol; nitrate of silver is particularly valuable, and in the proportion of 1 grain to the ounce (0.06–30.0) will be found sufficiently strong for use as a wash or injection. The superficial ulcerations may be further touched with the solid stick of the nitrate of silver. The prepuce having been retracted and the parts thoroughly washed, dusting powder, such as tannin or oxide of zinc, is distributed over the surface of the inflamed parts; the glans is then covered with a thin layer of absorbent cotton and the prepuce drawn forward. This dressing is to be repeated three times daily.

If the phimosis is so tight that the prepuce cannot be retracted, cleansing, astringent injections, and wrapping the penis in one or two thicknesses of gauze or other thin fabric, constantly kept wet with dilute lead-water, will be the treatment indicated. If, in spite of this treatment, inflammatory symptoms become more marked, splitting the foreskin or circumcision is indicated.

Prostatitis is a rare complication, and in its early course presents the symptoms of posterior urethritis. Where the acute symptoms are fairly developed direct local treatment is of little avail. Rest in bed, light diet, careful regulation of the bowels, medication to render the urine bland and unirritating, elevation of the pelvis, prolonged hot baths, rectal ice-bags, and the administration of morphine and belladonna, either by means of suppository or by hypodermic injection, represent the general treatment of all inflammatory conditions at or about the neck of the bladder. In the great majority of cases prostatitis undergoes prompt resolution, and this is more powerfully influenced by rectal irrigation than by any other method of treatment. For this purpose a two-way rectal tube must be employed, the nozzle of which is directed against the projection of the prostate into the bowel. From 2 to 4 quarts (2 to 4 liters) of normal saline solution, either very cold or as hot as can be borne, are allowed to flow into the rectum by gravity, this arrangement of the tubes allowing an injection to flow out as rapidly as it flows in. This treatment should be repeated three or four times a day. When, in spite of careful treatment and the free use of anodynes and antispasmodics, there is retention of urine, a soft catheter should be passed into the bladder and allowed to remain there.

If general and local symptoms denote abscess formation, the pus should be evacuated by perineal incision as soon as its definite location can be determined. It is true that the pus collection usually is spontaneously discharged into the urethra, but this result cannot certainly be depended upon, and, at best, is an unsatisfactory termination of the trouble.

When the inflammation runs into a chronic type, the treatment suitable for chronic posterior urethritis is indicated—namely, the use of large cold steel sounds, massage, and local applications to the prostatic urethra. In addition, rectal injections, by means of the two-way tube, are efficient in relieving symptoms.

Epididymitis as a complication of acute urethritis usually develops in the third week of the disease incident to overactive local treatment, sexual excitement, bodily activity, dietetic error, or constipation. In its hyperacute form it is attended by pain of crippling intensity, confining the patient to bed.

The testicles should be supported by a handkerchief bandage, the base of which is passed beneath the scrotum, while the ends and apex are secured in front to a circular band passing about the waist. To combat the agonizing pain saturated solution of magnesium sulphate is employed or a 5 per cent guaiacol ointment. These or other applications usually must be supplemented by hypodermic injections of morphine. Puncture with a tenotome is, in case of excessive swelling, at times advisable, or in hyperacute cases free incision and drainage. This when the local and constitutional symptoms of pus under tension are progressive. During the period of acute inflammation local treatment to the urethra is contraindicated.

On the subsidence of the acute inflammatory symptoms confinement to bed is no longer needful, providing the testis is properly supported by a suspensory bandage. This must be so arranged as to apply uniform pressure and at the same time exert the resolvent influences of heat and moisture. This end is attained by enveloping the entire scrotum in a thick sheet of absorbent cotton or of lambs' wool, applying over this a sheet of rubber dam and, finally, a properly fitted elastic jock-strap. The gauge as to the efficacy of this dressing is the comfort it affords.

When the acute symptoms have disappeared attention must be directed to the removal of infiltration, which if it persists may be a cause of sterility. This is accomplished by the continuance of heat, moisture, and pressure; by local applications, such as iodine gr. iv (0.25) in lanolin ℥j (30.0), or of equal parts of mercury ointment and belladonna ointment, or by ichthyol, with lard, half and half, and by the internal administration of iodide of potassium, 10 to 15 grains (0.65 1.0) three times daily. Vaccine treatment is often useful but severe reactions should be avoided.

Gonorrhea in the Female.

In treating the initial attack of acute gonorrhea in the female, greatest care should be taken to prevent the introduction of infection, from the urethra and the ducts of Bartholin to the cervix. Digital examination of the vagina should therefore be avoided in the acute stage, as well as douches. A digital examination is only permissible after the acute stage has passed and after thorough disinfection of the external genitalia.

In the chronic stage the disease is usually localized in the tubules of Skene or Bartholin's glands or the cervix. If the disease is confined to the tubules of Skene and Bartholin's ducts the best treatment is excision or cauterization. If the disease has also reached the cervix cauterization is the treatment of choice.

Aside from these facts the treatment of acute gonorrheal urethrits in the female, both local and general, is conducted on the same principles as when the disease attacks the male urethra. During the most acute stage no local treatment is advisable, but subsequently injections can be made with the ordinary hard-rubber syringe, not more than 1½ drams of the liquid being employed at a time. If the urethral discharge persists the seats of the suppuration are readily found by the endoscope tubes, and treated directly by applications of strong solutions of nitrate of silver or sulphate of copper. The results of treatment are commonly satisfactory.

Acute vaginitis is not very frequently observed, excepting in infants and young girls. In addition to the general treatment of inflammation, local treatment directed to cleansing thoroughly the inflamed surfaces of discharge and acting upon them by a strong antiseptic lotion is indicated. The patient is instructed to irrigate the vagina three times daily with 2 pints (1000 cc.) of permanganate of potassium solution, 1 to 4000, thrown in by means of a fountain syringe. For this fluid to reach every portion of the diseased mucous membrane it is necessary that the patient should lie upon her back with the hips elevated. Before rising a pledget of absorbent cotton is placed between the labia. During the most acute stage of vaginitis hot normal saline injections and prolonged hot sitz-baths are indicated. In addition to the antiseptic irrigations which the patient is directed to make, the physician should every second day insert a speculum and paint every portion of the diseased mucous membrane with nitrate of silver solution, varying in strength from 4 to 40 grains to the ounce (0.25–2.6 to 30.0). The vagina should then be lightly packed with tampons of wool cotton, which may be dusted with bismuth subcarbonate.

Chronic gonorrhea in the female, evidenced by purulent or mucopurulent discharge containing gonococci, usually from the Bartholin glands, those of the uterine cervix and those about the urethral meatus, is best treated by daily hot copious vaginal irrigations with permanganate of potassium, 1 to 4000, or biniodide of mercury, 1 to 8000. Treatment by cauterizing agents, applied directly to the gland ducts of the diseased area, is at times indicated. When the cervix is chronically infected, the actual cautery and excision have been employed with success.

The gonococcal infection is usually self-limited, and disappears under general hygienic and local cleansing agencies.

Vulvitis corresponds to balanitis in the male, and is treated in a similar manner. Cleanliness is the most essential point in securing a cure. The parts are thoroughly washed with weak antiseptic lotions, and the abraded mucous surfaces are kept from coming in contact by means of a piece of sterile gauze soaked in mild astringent solution. Vaccine treatment is indicated for chronic gonorrhea.

GOUT.

Gout is a word used to signify a series of manifestations occurring chiefly in those who have led an inactive life devoid of exercise, have lived on the fat of the land, and partaken more frequently of alcoholic beverages than of water; or it occurs in persons who do not live in this way, but whose ancestors have done so, and have transmitted to them the gouty taint or diathesis; or, once more, in those who have had poor food for a long time. In other words, it is a disorder of nutrition and metabolism. Very few Americans have gout in its marked and characteristic forms, owing to the active life they pursue, and to the fact that the inhabitants of the Western hemisphere drink large amounts of water, thereby continually dissolving effete matters in the system and washing them away. Nevertheless many Americans suffer from what may be called lithemic symptoms, which are due to lack of exercise, overeating, and perverted metabolism.

The therapeutic importance of pure water in this state is remarkable, but the so-called lithia waters depend for their value more upon their freedom from lithium salts than upon their presence. When a patient goes to medicinal springs, by continually drinking water he washes out the kidneys and prevents deposits of effete matters throughout the body. In a gouty individual the liquids of the body may be said to be so overladen with salts that they deposit them wherever a spot is found which is easy of access, just as water laden with lime forms a deposit on the sides of its bed in times of drought and dissolves and removes these formations when a freshet takes place. Very often, when pure waters are not attainable, satisfactory results will be obtained from ordinary distilled water, the insipid taste of which can be overcome by charging it with carbonic acid gas.

When an acute attack of gout comes on, it is generally situated, as is well known, in the joint of the big toe, but it may involve any part of the body, even to the heart and the abdominal viscera. By far the best remedy for the relief of the pain, if it is unbearable, is morphine, which should be given hypodermically. At the same time the best remedy for gout that we have, colchicum, should be freely given until the patient shows the full effect of the drug, as evidenced by gastro-intestinal discomfort or pain and slight laxity of the bowels. The drug should be used in the form of the tincture of the seed, in the dose of 40 minims (2.6) at first, and increased by 2 minims (0.12) every four hours until relief is obtained or symptoms of overdose appear as noted above. In other instances the method of administration suggested in the article on Colchicum may be resorted to.

Many physicians at the present time prefer the somewhat more agreeable method of using colchicum in the form of colchicine salicylate, which is a mixture of colchicine and oil of gaultheria, about $\frac{1}{100}$ grain (0.0006) of colchicine being present in each capsule and 3 to 6 being given each day, at intervals of a few hours.

The local treatment of gout, when it is active, consists in the application of a number of remedies. For hospital practice a very useful mixture is made by adding 1 part of bicarbonate of sodium to 9 parts of linseed oil. The joint is then wrapped in a piece of lint soaked with this concoction. In other cases collodion may be applied in one or two good coats, not more, with relief, and in still others oil of peppermint has been recommended. It is to be remembered, however, that the inflamed joints are not to be treated by depletion through leeches or bleeding, as by this means they ultimately become worse; or, in other words, the treatment of gouty inflamed joints is not identical with that of inflamed joints from other causes. When the pains of acute gout are very severe at night, sodium iodide, in the dose of 15 grains (1.0) at four or five o'clock in the afternoon, will sometimes give relief; this drug should always be combined with colchicum if the disease is subacute or chronic.

In chronic gout, except during the acute exacerbations of the disease, colchicum is almost useless, but sodium iodide should be pushed to the point of iodism if the trouble be painful. Here diet forms an important part of the treatment, and should consist of foods which are not fatty nor rich, but plain and nourishing. Milk and eggs, the moderate use of fresh meat and fruits, cooked without sugar being added, are allowed, tea and coffee being used only in moderation. If any wine is taken, it must be followed by copious draughts of pure water, and this last article should be used *ad libitum*. On the other hand, pastries, and, more than all, sweet wines, are the worst things that such a patient can take, and must be absolutely prohibited.

The insomnia of chronic or subacute gout is best overcome by strontium bromide and chloral, the former drug being the safest and best. Barbital or barbital sodium are also useful.

Nothing should be done in the neighborhood of gouty joints which will injure the skin, as it is easily disorganized and its injury may lead to erysipelas. Where the deposit around a joint is very great and the normal movements are impossible, relief is often obtained by the application of a solution of citrate or carbonate of lithium, 5 to 10 grains to 1 ounce (0.3–0.6 to 30.0) of water, on lint wound around the parts. Where the skin is broken and will not heal, this treatment often permits healing by dissolving the crystals in the wound which prevent approximation of the edges and cause local irritation.

Iodine ointment, or the tincture of iodine, is often placed around chronic gouty joints with advantageous results.

A standard remedy in subacute or chronic gout is arsenic, and its administration in the form of 3 minims (0.2) of Fowler's solution, with either perfectly pure or potassium water, is always to be resorted to when the iodides and colchicum are temporarily abandoned. If anemia is present, arsenic is particularly indicated, and cod-liver oil and syrup of the iodide of iron are also of value in this state. Gouty patients should take as much exercise and be in the fresh air and sunshine as much as possible.

We find, therefore, in conclusion, that the use of large amounts of pure water free from salts, and the administration of colchicum, sodium iodide and arsenic are the greater points about which treatment should center. (See Cinchophen and Neocinchophen in Part II.)

HAY FEVER.

(See POLLEN EXTRACTS, PART III.)

HEADACHE.

(*For Neuralgic Headaches,* see NEURALGIA; *for Bilious Headache,* see BILIOUSNESS.)

Probably no single source of pain compares in its frequency to headache, chiefly because it is essentially a symptom of many disease processes or functional disturbances. It may arise from constipation or eye-strain, from brain disease, from anemia, from uremia, from plethora, from nervous breakdown, and from a multitude of causes which, if they were all recounted, would cover many pages of this book.[1] In many instances the employment of a mild laxative, which will cause the bowel to empty itself thoroughly, is a necessity. In others a careful measurement of the amount of urine passed in the twenty-four hours will show that the urinary secretion is deficient in liquids and solids, so that effete and poisonous materials are retained in the blood, which produce headache. For such cases, if the urine is acid, the frequent use of Vichy water (Célestins Spring), to which is added a little bicarbonate of potassium as a diuretic, will prove of great service. If the urine is alkaline, 10-grain (0.6) doses of ammonium benzoate three times a day are often useful.

Congestive headaches, dependent upon engorgement of the cerebral vessels with blood, are to be treated in a number of ways. If any direct cause of congestion can be discovered, this must, of course, be removed. So far as the direct application of drugs is concerned, we find two methods of promoting a cure, according to the cause. Thus, if the patient be neurasthenic and feeble, the use of ergot and strychnine, which will cause contraction of the dilated vessels, is useful; whereas if the congestion is due to high arterial tension and excessive cardiac action, the bromides and the employment of vascular sedatives, such as nitroglycerin and aconite, which will produce arterial depression and so remove congestion, are indicated. It is to be remembered that when the congestion is due to vascular relaxation and weakness vascular sedatives are contraindicated.

The use of a hot mustard foot-bath is of great value, and a mustard-plaster or dry cup applied to the nape of the neck is often of service in congestive headaches, while in severe cases an ice-bag applied to the head or leeching behind the ears or on the temples may be resorted to. Bleeding often gives relief at once in severe congestive headache.

In nervous women who suffer from headache much comfort and relief will often ensue if the top of the head be wet with one of the following formulæ:

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[1] See chapter on Headache in the author's Symptoms in the Diagnosis of Disease, 9th ed. Lea & Febiger, Philadelphia.

℞—Spiritus camphoræ		f℥j (30.0)
Spiritus lavandulæ,		
Alcoholis	āā	f℥ij (60.0).—M.

S.—Apply locally.

Or,

℞—Camphoræ,		
Olei menthæ piperitæ	āā	ʒj (4.0)
Chloroformi		f℥ss (16.0)
Alcoholis	q. s. ad	f℥iij (90.0).—M.

S.—Shake the bottle and apply a little of the liquid to the head.

In other instances bathing the head with cologne-water to which have been added 5 grains (0.3) of menthol to the ounce is useful.

Where headache depends upon fatigue, either general or local, stimulating treatment is necessary. If eye-strain be the cause, full doses of strychnine or nux vomica are of service, but these remedies cannot be used if there is much retinal irritability. Proper eyeglasses are, of course, indicated in such a case.

In many instances a combination of caffeine, bromide of potassium, and antipyrine is very successful, as follows:

℞—Caffeinæ citratæ	gr. xl (2.6)
Potassii bromidi	ʒiv (16.0)
Antipyrinæ	ʒij (8.0).—M.

Fiant chartulæ, No. xx.
S.—One powder in water as needed.

Another useful prescription is:

℞—Codeinæ sulphatis	gr. ii (0.1)
Acetanilidi	gr. xx (1.3).—M.

Pour in capsules, No. iv.
S.—One capsule every four hours.

Sometimes the caffeine makes the headache more acute, and if this occurs only the antipyrine and bromide can be used. (See articles on Antipyrine, Acetanilid, Cannabis, Gelsemium, and Acetphenetidin (Phenacetin).)

Sleep is generally a more useful prescription than any drug, and if city life creates so much mental anxiety during the day as to be wearing upon the nervous system or make the patient wakeful at night, business must be put aside and health and recreation sought at a watering place. Horseback exercise is very useful indeed, and should be resorted to by all who can afford it if they are sufferers from nervous headaches. Walking is also useful.

A form of headache which is often very severe, sometimes fleeting, sometimes persistent, is that due to gout, and it is to be treated by means quite distinct from those named so far. Some practitioners of wide experience employ salicylic acid in doses of from 5 to 15 grains (0.3–1.0), while others rely on the iodide or acetate of potassium. (See Migraine.) Aspirin in 10-grain (0.65) doses is very useful.

Other cases of a gouty headache require colchicum, particularly if the gout be widely distributed in its manifestations, and to these Hamilton gave:

℞—Vini colchici seminis		f℥ss (16.0)
Potassii acetatis		ʒv (20.0)
Potassii iodidi		ʒv (20.0)
Tincturæ cimicifugæ		fʒv (20.0)
Aquæ destillatæ	q. s. ad	f℥iv (120.0).—M.

S.—Teaspoonful (4.0) every four hours.

In cases in which anemia is associated with the gouty tendency Peabody used the following prescription, the ingredients of which are compatible, whereas most of the preparations of iron and salicylic acid are incompatible:

℞—Acidi salicylici	gr. xx (1.3)
Ferri pyrophosphatis	gr. v (0.3)
Sodii phosphatis	gr. j (0.06)
Aquæ destillatæ	f℥ss (16.0).—M.

S.—To be taken every three hours.

Cohen has used the following, which is more pleasant to the taste:

℞—Sodii salicylatis		ʒiv (16.0)
Glycerini		f℥ij (60.0)
Olei gaultheriæ		♏xx (1.3)
Tincturæ ferri chloridi		f℥iv (16.0)
Acidi citrici		gr. x (0.6)
Liquoris ammonii citratis, B.P.[1]	q. s. ad	f℥iv (120.0).—M.

S.—Dessertspoonful (8.0) in water twice, thrice or four times a day.

(For the treatment of migraine, see Migraine.)

HEART DISEASE.

(*For Treatment of* ANGINA PECTORIS, see p. 722.)

The writer classifies all forms of heart disease under this heading advisedly In valvular disease the profession understands more and more that the mere destruction or laming of this valve or that has little to do with the treatment, although the ultimate result of the case is somewhat dependent upon these conditions. It matters not whether the leak in a valve be minute or great, provided the heart can still do its work; the condition of the cardiac muscle is the important factor to be considered. If an *irreparable* leak exists in a pump which cannot be stopped for repairs, the question is not, Can we cure that leak? but rather whether we can work the pump with enough force or rapidity to obtain all the water needed for the maintenance of life. Some physicians use heart tonics, such as digitalis, whenever they find a valve diseased, as if to mend the broken valve. Nothing can be more erroneous, for a valve once injured is never regenerated. It is only in those cases which have relaxation of the muscular fibers around the orifice that digitalis can cure a murmur of mitral regurgitation.

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[1] Liquor ammonii citratis, B. P., is made by adding 5 fluidounces (imperial measure) of strong solution of citrate of ammonium to 15 fluidounces (imperial measure) of distilled water. The stronger solution of citrate of ammonium is made by taking 12 ounces (avoirdupois) of citric acid, strong solution of ammonia 11 fluidounces, and adding enough distilled water to make 24 fluidounces (imperial measure).

It should be an invariable rule with every physician in examining a patient with heart disease to determine whether or not the tissues of the body receive their normal blood supply. If they do not, even though the leak is so small as almost to escape notice, treatment is to be instituted; but, on the other hand, if the murmur heard on auscultation is as loud as that of a machine shop and the tissues are not starved, no remedy is needed. Indeed, it not rarely occurs that no murmur can be heard in the presence of signs of circulatory feebleness, because the heart may be too feeble to drive the blood past the leaking valve with sufficient force to produce any sound.

Another very important point in regard to the treatment of cardiac disease in children is the remembrance that the stunting of the body and the slowness of growth are not merely the result of heart trouble, whereby the tissues do not increase in size from lack of nourishment, but occur for a special purpose. Let us suppose that a child of eight or nine years has scarlet fever or rheumatism, which leaves the cardiac valves impaired in function, the question must arise, "Can the heart properly fill the bloodvessels?" If the heart can supply the vessels, the child lives, but is stunted, because Nature is wise enough to understand that the struggling heart has all it can do to supply even a stunted frame, and realizes that a rapidly increasing area of bloodvessel surface in a growing child would exhaust the cardiac muscle.

The physician should not permit the parents to worry over this lack of growth, but by the use of gentle gymnastics or tonics, and attention to the general health, he is often enabled to improve the cardiac condition. As soon as this organ is strong enough to permit of growth, growth will take place.

In the general treatment of heart disease the most important thing for the physician to prescribe is rest. The matter of rest is most important if the heart is tired or if its efficiency is impaired by myocardial degeneration. Haldane has estimated that the 8 pints of blood in an adult is driven through the entire circulation in every forty seconds when at rest. This is equivalent to stating that 12 pints of blood, that is, 6 for each ventricle, go through the heart every minute, which Wilson, of England, points out means that over 2000 gallons, or about 8 tons of blood, are driven by the heart in each twenty-four hours. When exercise is taken the increase in effort is greatly increased, for arterial pressure is raised and more blood required, which results in a quickened pulse-rate. It is important to remember, however, that the healthy heart has a very great reserve of energy, and each abnormal heart must be studied to determine just how much the patient may require it to do. A tired heart cannot supply an active body. A very definite idea of how fatigued the heart muscle is, or how much it has failed as the result of myocardial degeneration, can be obtained by the stair-climbing test. If the heart is normal the blood-pressure rises under exercise, but if it is feeble the blood-pressure falls. So, too, if the difference between the diastolic pressure and the systolic pressure is low this is also indicative of a weak heart as a rule. Furthermore, a weak heart quickens inordinately under exercise and remains rapid for several minutes, or even an hour, whereas a normal heart very soon slows down when effort ceases.

Too little attention is paid to nutrition in sufferers from cardiac failure. The tendency is to give digitalis to cause the heart to do more work without recalling that more work means the need of more nourishment. For this reason care should be taken as to diet and the value of dextrose and alcohol as suppliers of energy is to be borne in mind. A congested liver after being relieved of its congestion should receive dextrose to restore its glycogen and to protect its cells.

Having made these preliminary remarks, let us turn to the direct application of drugs to heart disease, the chief drug in the list being, of course, digitalis.

The value of digitalis may be said to rest upon a number of influences possessed by it. In the first place, evidence is constantly accumulating to show that digitalis increases the nutrition of the heart muscle by the stimulating influence which it exerts on the pneumogastric nerve, this nerve having been partly proved to be a trophic nerve of the heart. Aside from any such nervous influence, the heart muscle receives a greater blood supply under the use of digitalis, since both diastole and systole are influenced by the drug, the systole being more complete and the diastole being prolonged and more extensive.

Two theories concering the nutrition of the heart muscle through its blood supply have been promulgated. One is, that the coronary arteries are filled with arterial blood as the heart drives its contents out of the left ventricle into the aorta, or, in other words, during systole. The other hypothesis rests upon the belief that the contracting muscle prevents a free circulation of blood through the cardiac bloodvessels, and that the blood is driven into the coronary arteries during diastole by the pressure in the aorta, the aortic valves being closed. The latter view is incorrect so far as the coronary arteries are concerned, for they are filled during ventricular systole, and this systolic contraction of the muscular fibers urges onward the blood already in the intramural vessels. Nevertheless the complete passage of the blood through the smaller vessels of the cardiac muscle only takes place as relaxation or diastole occurs. The ground for this belief consists in the observation that a muscle when firmly contracted always presses upon its supplying bloodvessels, and partially interferes with capillary flow. The heart of one of the lower animals, if carefully watched after the chest-wall is removed, will always be found to become paler during systole and redder during diastole. As the blood everywhere in the body nourishes the tissues, not when in the arteries, but while passing through the capillaries, it would seem self-evident that, while the coronary arteries are filled by the systole or contraction of the heart, the nutritive changes and perfect capillary circulation go on during diastole. If these premises are true, the increase in cardiac nutrition and growth under the action of digitalis is only what one would expect, for we have learned when studying this drug that it prolongs diastole and increases the force and volume of the systolic wave of blood. In other words, digitalis fills the coronary arteries very completely, and so, when diastole occurs, not only floods the cardiac capillaries with blood, but prolongs the period during which the interchange between the blood stream and tissues takes place.[1]

The heart must maintain an adequate circulation not only for the body in general, but for its own sake as well, for the consumption of oxygen by it is greater than that of any other organ in the body. During severe exercise it uses one-fifth of all the oxygen supplied by the lungs, and in severe dyspnea we have severe exercise. (See Oxygen, Part II.)

The value of the regulating or inhibitory influence of the vagus has become more apparent with the advance made recently in our knowledge of the physiology of the heart. Thus it has been shown that in systole the heart muscle becomes refractory to stimuli and loses its irritability, contractility and conductivity, all of which are restored during the diastolic pause. Further than this, the efficiency of the heart is apparently in direct ratio to the length of the diastole, that is, of the period of resuscitation. This period of diastole in health is much longer than the period of systole, the ratio being diastole 0.483 second and that of systole 0.379. When the heart is increased the speed results in a shortening of diastole rather than of systole. (See article on Digitalis, Part II.) Digitalis, by stimulating the heart, causes it to put forth more energy, and yet by prolonging diastole and slowing the rate rests the heart.

Normally, the heart beats fast or slowly according to the demands for blood made upon it by the system, and its action is varied by the calls which it receives from the tissues. In heart disease, with failure of compensation owing to leaky valves, the tissues are starved, and continually send messages for more nourishment to the cardiac muscle, which finally becomes exhausted by its endeavors to supply their wants, and beats faster and faster in its efforts to compensate for the leak. If digitalis is given, the vagi render the cardiac action regular and effective, acting as a regulator and director of its energies, thereby supplying the tissues and using the remaining power of the heart to the greatest advantage, in addition to improving its blood supply by the methods already described. The starving tissues of the body having been satisfied, as Wood has eloquently expressed it, "the angry messengers from the periphery cease their callings, and the heart is at peace and in comfort."

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[1] See article on Digitalis in Part II of this book.

From what has been said it becomes evident that this drug (digitalis) generally does good when the heart is feeble, and we find for this reason that cardiac dilatation, simple cardiac failure, or heart failure dependent upon the presence of poisons, all indicate its use.

The question to be asked the physician of himself when in the presence of a weak heart is What am I to try to do? If the heart is utterly fagged out as the result of the labor induced by valvular lesions the answer usually is to give one large dose of the tincture by the mouth, 1 to 2 drams (4.0–8.0), and wait for effects, giving much smaller doses later on to maintain the effect. So too, if auricular fibrillation is present such a course should be followed. (See article on Digitalis, and Quinidine under Cinchona, Part II.) If the heart is not utterly fagged but tired then doses varying from 15 to 20 minims (1.0–1.3) of the tincture three times a day are all that is needed with rest or somewhat larger doses soon cut down. Before giving the very large doses, however, the physician must be sure that partial heart-block is not present and that the patient is not already digitalized by another practitioner.

The mechanism of the action of digitalis in the different cardiac valvular lesions still remains to be described, but before doing so the author desires to remind the reader that a patient under the full influence of digitalis ought to maintain the recumbent posture. (See article on Digitalis.) Further, the effect of the drug tends to accumulate, and therefore it should be stopped for several days at the end of each week of its use when it is given in full doses.

Taking up the most common condition, that of mitral regurgitation, we find that in this disease the blood passes, in its normal flow, from the left auricle into the ventricle, and, when the ventricle is filled, that the cardiac muscle contracts on all sides equally. Normally, the mitral valves close the auriculo-ventricular opening and prevent any of the blood from regurgitating into the auricle, and the greater the pressure the tighter they become. Abnormally the blood is still pressed upon on all sides as before, and, trying to escape, as do all liquids, from pressure, finds that, owing to disease of these valves, it can in part at least, slip back into the auricle from which it came, rather than pass out into the high pressure of the arterial system. The ventricle, therefore, propels blood in two directions—in the wrong way and in the right way. If the leak is large enough to permit of the regurgitation of a large part of the blood, then death occurs. Digitalis does good in mitral regurgitation because, by increasing the force of the ventricle, it increases the friction at both the mitral leak and the aortic opening; but, as the aortic opening is a large one and the mitral leak a small one, the greater quantity of blood passes out into the circulation. It also does good because it strengthens the heart muscle and contracts the muscular ring which surrounds the auriculo-ventricular orifice, therefore rendering it easier for the valves to close the mitral opening. The same fact arises for consideration as before—namely, that it is not the amount of leak, but the amount of supply to take its place, which is the vital question in the case. Rarely relief does not occur, and the patient is made worse by digitalis, because the leak is increased as much as the normal flow.

Murmurs associated with evidences of cardiac failure do not always indicate the presence of valvular disease, for dilatation of the mitral orifice may prevent the proper approximation of the valves. In such a case digitalis, by overcoming the relaxation, may produce cure of an apparent valvular defect.

In mitral obstruction the difficulty is that the blood cannot enter the ventricle with sufficient rapidity, and this part of the heart contracts *before* it is well filled. By the prolongation of diastole the blood is given sufficient time to enter and the ventricle is filled, sending out into the system a large wave of blood when it contracts. Further than this, the stimulation of the right ventricle by the digitalis enables this part of the heart to overcome the tendency to congestion which arises from the obstruction in the left side of the heart. Often the right side of the heart must be relieved by venesection and active purgation.

When the obstruction at the mitral orifice is so great that the auricle becomes distended and its power impaired so that it cannot well propel blood through the auriculo-ventricular opening, it not infrequently happens that great arrhythmia develops, not only as to the regularity of the heart sounds, but also in respect to the amount of blood which is expelled at each ventricular contraction. This irregularity is not alone due to stretching and exhaustion of the auricular wall, but to damage of His' bundle by the inflammatory process originally present, whereby tissue was destroyed, or the blood supply of the bundle was interfered with. Such a lesion in His' bundle may result in preventing some impulses from reaching the ventricle and so beats are missed. (See Digitalis, Part II.) Digitalis should be given with great caution, or not at all, in mitral stenosis with missed apex beats due to partial heart-block, because by its power of still further decreasing the conductivity of His' bundle, it may induce complete heart-block so that the auricles and ventricles are completely dissociated. Under these circumstances, the use of digitalis had better be avoided, or only small doses used, until, by rest in bed, purgation and the use of other remedies, such as caffeine, strychnine, or ammonia, the action of the heart is improved. Atropine in the dose of $\frac{1}{100}$ grain (0.0006) four times a day is very useful. If there is much orthopnea and other evidence of circulatory failure, strophanthin or strophanthone may be given intravenously, but it is not to be forgotten that after the use of full doses of digitalis this use of these active principles may induce sudden cardiac arrest. Strophanthin is given in the dose of 1 cc. of a 1 to 1000 solution, put up in ampoules. Strophanthone diluted with salt solution may also be given hypodermically in the dose of 1 cc., the contents of 1 ampoule equal to about $\frac{1}{65}$ grain of strophanthin, as it does not cause the intense irritation caused by strophanthin, or intravenously, in the dose of 0.5 cc. or $\frac{1}{2}$ ampoule. (See Strophanthus.)

In an attack of true block, or Stokes-Adams disease, adrenalin 10 minims (0.65) of the 1 to 1000 solution may be given into the cardiac muscle if heart arrest has occurred, as an emergency agent. Barium chloride grain $\frac{1}{2}$ (0.03) four times a day by mouth may be employed to prevent attacks, given for several weeks. The reason for its use is that it increases the irritability of the ventricle which may set up its own contractions. Digitalis does this but increases the block.

Tachycardia, or rapid beating of the heart, occurs in several types. One is called sinus tachycardia. It can often be relieved by digitalis because of the increased activity of the vagi on the heart's action. It possesses but little evil import, whereas if the tachycardia is ventricular it is a grave sign and digitalis often fails. Another is paroxysmal tachycardia probably due to gastro-intestinal or nervous disturbance in which digitalis does little good, unless given with the bromides. A third is due to auricular flutter in which digitalis does good, curiously enough first changing the flutter to fibrillation followed by normal rate. Tachycardia characterized by great irregularity is usually due to auricular fibrillation, in which digitalis may do great good, *particularly if there is failing compensation*, which is usually the case. In this state the auricle does not contract at all, but remains dilated, and over its surface fibrillary thrills occur. Irregular impulses pass to the ventricle from the sino-auricular node by way of His' bundle, and the ventricle acts of itself, the auricle being only a dilated bag through which the blood passes. The signs of auricular fibrillation are a disappearance of the presystolic murmur and the development of a ventricular pulse in the jugular veins, best discovered by the use of a sphygmocardiograph, and the electrocardiograph. The digitalis does good by stimulating the right ventricle, whereby it drives the blood through the left auricle, and by increasing the power of the left ventricle improves the systemic circulation. It also tends to block some of the shower of impulses which attempt to cross His' bundle. Large doses are usually needful in this state, but they should not be continued over two or three days as a rule. Their continuance should be controlled by the use of the electrocardiograph. (See Figs. 120, 121, 122 and 123.) If such aids are not at hand the physician should count the apex-beats and the radial pulse. There will usually be found a deficit in the pulse, because only some of the beats reach the wrist. If the deficit decreases under digitalis, that is, if the apex-beats and radial beats become more and more nearly

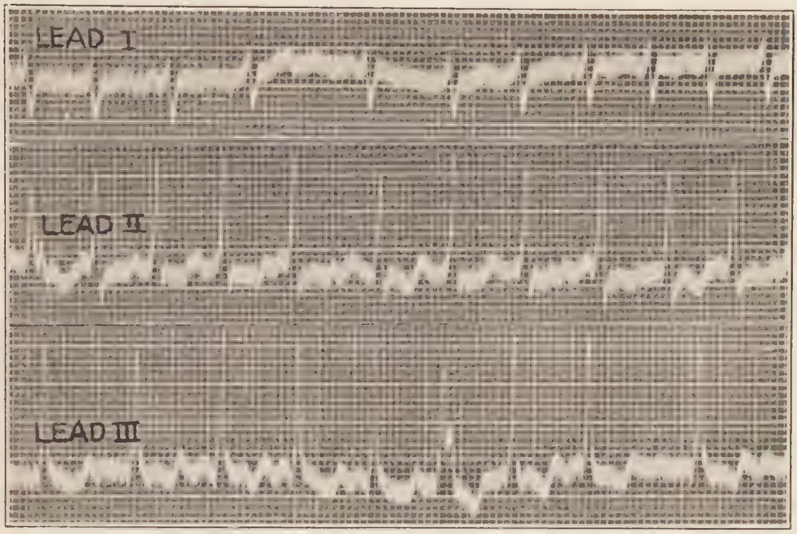

FIG. 120.—Auricular fibrillation. Ventricular rate approximately 135. Before the use of digitalis.

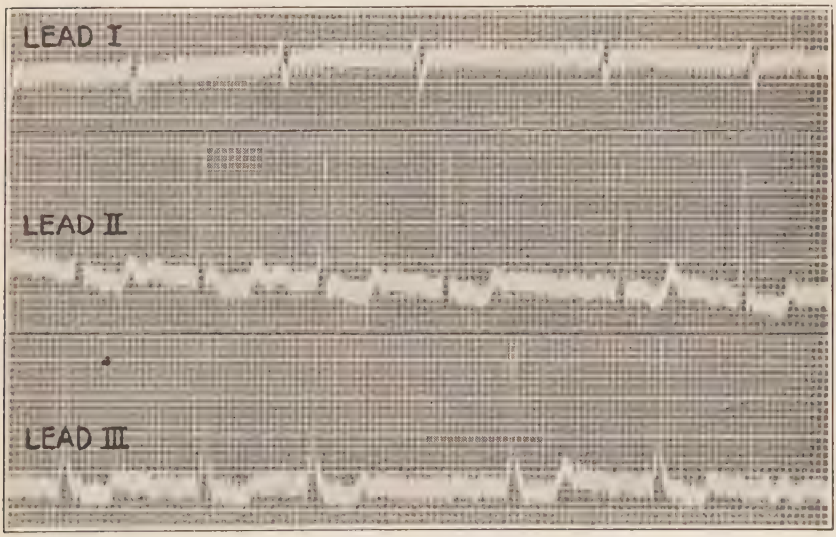

FIG. 121.—Auricular fibrillation. Ventricular rate approximately 70 after receiving tincture of digitalis 1.0 cc for seven days.

equal in number, the drug may be considered as acting well. (For quinidine in auricular fibrillation see article on Cinchona, Part II.) When the pulse gets as low as 70 to 80 beats a minute, or vomiting occurs or a coupled heart-beat is present, these are signs for stopping the drug. (See Digitalis, Part II.)

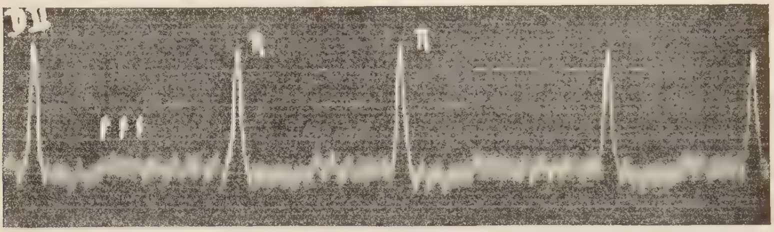

Fig. 122.—Auricular fibrillation. (Lutembacher.)

In aortic stenosis there is obstruction to the normal flow of blood out of the heart and digitalis is needed if the ventricle is failing to increase the ventricular force, so that it may overcome the difficulty.

In aortic regurgitation digitalis, by its stimulation of the heart may cause a sufficient output of blood to clear itself of the regurgitant flow, but in some cases the drug fails because the prolongation of diastole gives so much more time for the blood to flow backward into the dilating ventricle. If the mitral valves are incompetent because the left auriculo-ventricular orifice is stretched or the valves diseased as a complication of aortic regurgitation it is indicated if the circulation is weak. The other cardiac remedies to be used in such cases are strophanthus, in the form of the tincture, dose 5 to 20 drops (0.3–1.3); adonidin, dose $\frac{1}{4}$ to $\frac{1}{2}$ grain (0.015-0.3); and sparteine, $\frac{1}{2}$ grain (0.3). These remedies may also be used in the other forms of cardiac disease where digitalis fails.

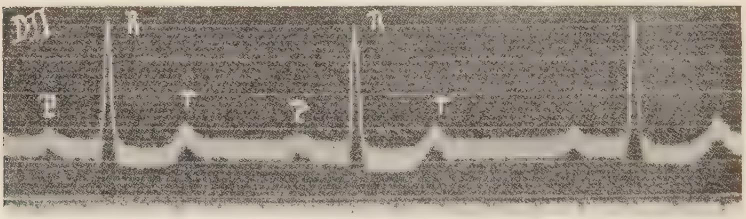

Fig. 123.—Restoration of normal sinus rhythm on the eighth day by the use of quinidine. (Lutembacher). Note prolongation of P R interval and development of T wave.

Physicians often meet with cases of severe valvular disease in which there are present a laboring heart, distended jugulars and cyanosis, indicating engorgement of the right ventricle. This is to be relieved by free venesection from the arm or by the use of a mercurial and a saline purge, and digitalis.

When cardiac failure in valvular disease is severe it is often wise in addition to the use of digitalis to give dextrose intravenously because the heart is dependent upon a large store of glycogen. It is best used in 20 per cent solution to the extent of 50 to 100 cc. given very slowly. (See Intravenous Injection, Part III.) Whisky is also useful.

If many cases of cardiac disease there are associated with the heart lesion general debility and anemia. These cases should be treated not only by the use of heart tonics, but also by iron, arsenic, simple bitters, and, if constipation is present, by mild purgatives. Five drops of Donovan's solution three times a day are often very useful, particularly if there is an old specific history.

In cardiac dropsy digitalis and the other heart stimulants do good by raising blood-pressure and pulse force, and in some instances by helping the kidneys to increased efforts at elimination. (See Dropsy.) In these cases, too, the patient will often be greatly benefited if he receive every few days a full dose of blue mass and of one of the hydragogue cathartics, which will relieve the dropsy and unload the portal circulation. (See Colocynth.)

On the other hand, if the heart is feeble and the arterial tension is high, not only must sodium nitrite be given to relax the spasm, but in addition a cardiac tonic must be employed. As digitalis is prolonged in its effect and sodium nitrite is fleeting, the digitalis should be given every eight or twelve hours, and the sodium salt every three or four hours.

In cases of threatened ruptured compensation or cardiac fatigue, before attempting to lower blood-pressure which is higher than normal, the physician must be sure that such a high pressure is not essential for the comfort and even the life of the patient, as fibroid, tortuous vessels render a high pressure necessary if the circulation is to be maintained. In such instances the nitrites do no good and often do actual harm. The circulatory strain is best relieved by the use of the electric-cabinet bath or any form of hot-air treatment with massage, and the use of the iodides may be valuable.

When compensation is suddenly ruptured and circulatory failure is imminent, the use of ether and ammonia is to be resorted to at once, and these are to be followed by strophanthin intravenously or strophanthone intravenously or hypodermically, or by digitalis by the mouth or digitalone hypodermically. It is to be borne in mind that the intravenous use of digitalis is dangerous, that given intramuscularly it does not induce its maximum effect for nearly two hours, if then, and that when administered by the mouth its maximum influence does not appear for four to eight hours. Digitalis does not meet our immediate need. It can only be relied upon to support the heart after more rapidly acting drugs have been employed. Pituitrin-O may also be given intramuscularly, the contents of an ampoule being used. If venous turgescence is present great relief often follows free venesection. (See Venesection.) Venous engorgement can also often be relieved by the free use of of oxygen. (See Oxygen, Part II.)

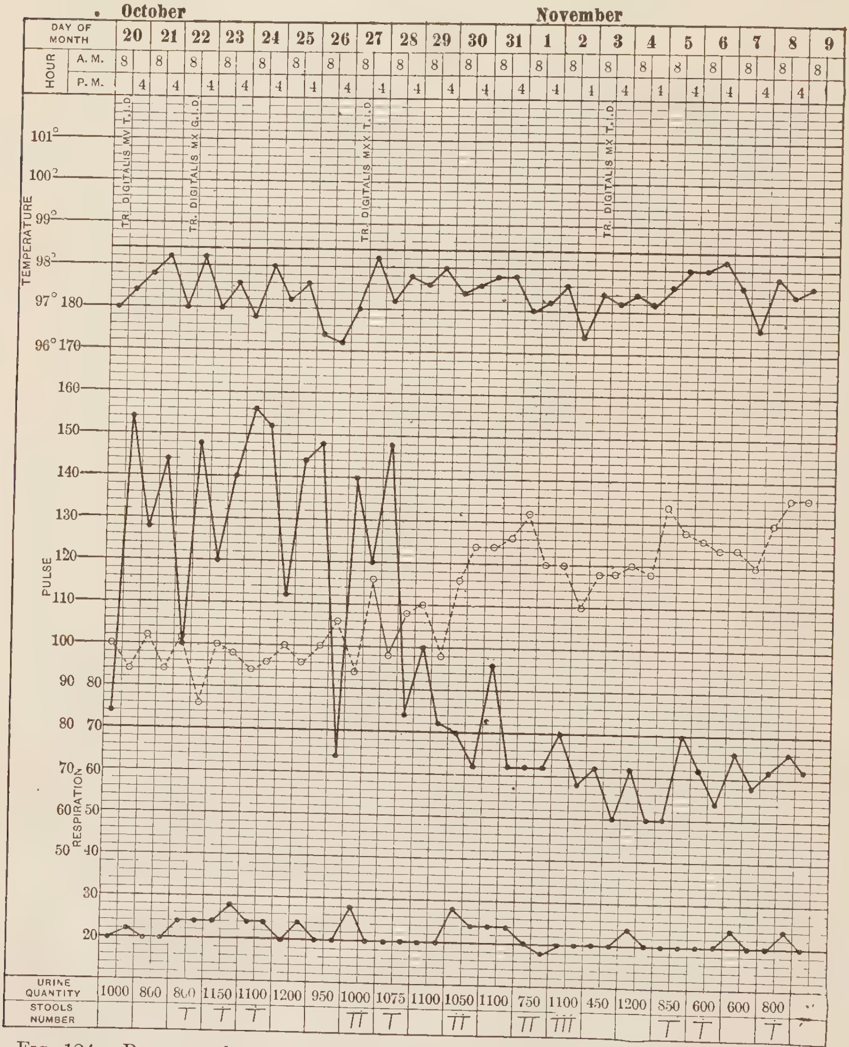

FIG. 124.—Paroxysmal tachycardia. No benefit from moderate doses of digitalis. Large doses cured. Blood-pressure rose as pulse-rate fell. Dotted-line pressure.

In cardiac palpitation dependent upon indigestion, this condition must be relieved by appropriate digestive remedies; but in that form of palpitation due to overexertion or heart strain digitalis is useful. Iron is to be used if the irritability is due to anemia. Tea, coffee, tobacco, and excessive venery are to be forbidden. Sometimes nux vomica does good by stimulating the heart and nervous system, and belladonna seems of great value where arrhythmia is present. In other cases of arrhythmia the patient will be more benefited by the use of sparteine, or aconite and digitalis with one of the bromides. (See Aconite.)

In cardiac dilatation and asthenia digitalis is often very useful; but should the patient be advanced in years and have a tendency to arteriospasm we should, simultaneously, give sodium nitrite or iodides to relieve any arterial spasm which resists the action of the heart. Very often such patients will suffer from scanty secretion of urine and albuminuria, and will develop congestion of the kidneys. This may be controlled and greatly relieved by the use of full doses of digitalis, say 10 to 15 drops of the tincture every four hours, with 20 grains of bitartrate or citrate of potassium every four hours. The addition of the diuretic very greatly aids in the diuretic effect of the digitalis in these cases. Sometimes diuresis can only be established after free purgation. In some cases it is wise to substitute caffeine for the digitalis, say 3 grains (0.2) of pure caffeine. (See Novasural, Part II.)

In cases of myocardial degeneration arising during the course of acute infectious fevers, digitalis is of little value. In chronic myocarditis with or without valvular disease it may prove helpful, but if it causes irregularity must not be continued. (See Mitral Stenosis on a previous page.)

Cardiac hypertrophy is rarely seen without some other lesion accompanying it, but it may occur from prolonged and excessive exercise or other cause. It is to be treated by absolute rest or avoidance of excessive exercise, and by moderate amounts of food of a non-stimulating character. Wines and coffee should be forbidden, and a belladonna plaster may be placed over the precordium if the action of the heart is very excessive. Both palpitation of the heart and cardiac hypertrophy are favorably influenced in many cases by aconite or veratrum.

Every patient who has an irregular heart has not necessarily a diseased heart, and digitalis may not only be useless but harmful. Thus, extrasystoles, particularly in youth, have no evil significance, and usually disappear on effort. If they increase on effort they may have evil significance provided tobacco and excessive sexual activity are not present as factors. In some of these cases of functional disturbance advice, based on the idea that a lesion is present, may have very unhappy effects on the disorder and disturb the patient's morale. The bromides or other sedatives are more useful than is digitalis in most of these patients, particularly if belladonna is given with them.

Physicians who are in the habit of examining young men professionally will constantly have their attention called to a condition of shortness of breath on exertion, palpitation, or violent pulsation of the heart, and in some instances the development of severe symptoms which, at first glance, may seem to be those of true angina pectoris. In many of these youths there will be a history of the excessive use of tobacco, or that they have left college, where they indulged in severe athletic exercise, such as running or bicycle racing, and have entered business, where they lead a most sedentary life. In these cases the condition which exists is comparable to that which exists in a steamship whose engines are too strong for her hull. The heart, which has heretofore been supplying the body of an athlete with blood, now finds itself too strong for the sedentary individual. There is probably no remedy which will give such good results under these circumstances as aconite, in the dose of 1 minim (0.06) of the fluidextract or 5 to 10 minims (0.3–0.6) of the tincture three times a day, particularly if at the same time a good belladonna plaster about 4 inches square is applied over the precordium. Many cases of tobacco heart, in which there is arrhythmia, with an excessive cardiac impulse over the precordium, with palpitation on exertion, will be benefited by aconite used with a bromide; but where the heart seems much depressed, so that the apex beat is feeble and the first and second sounds are not clearly heard, aconite will seldom, if ever, do good.

Passing to the employment of aconite in cases of true cardiac disease, we find that a careful study of a certain number of cases will soon show the physician that this drug is capable of doing more good in some instances than is digitalis.

The history of the following case illustrates this point: A man, aged nineteen, was brought to the hospital suffering from aortic regurgitation, and as a result of this was attacked with dyspnea on the slightest exertion, marked cardiac arrhythmia, with palpitation, some giddiness, and a tendency to nose-bleed. He stated that in the early part of the year, and for several years preceding it, he had been a deck-hand on a coastwise vessel, where he performed hard manual labor, notwithstanding the condition of cardiac disease which was present, and of which he knew nothing. During this time he suffered from no symptoms indicating cardiac disorder. In other words, compensatory hypertrophy was complete. Because of the exposure incident to his work he was forced, under the advice of a physician, to earn his living on shore. He was not successful in obtaining employment, and a prolonged period of muscular inactivity followed. As a consequence the cardiac hypertrophy, which had hitherto been compensatory, became excessive, and he suffered from marked cardiac palpitation, with a throbbing sensation in the extremities, and from a distressing cough. Early in the study of the case it was recognized that these disorders were due to the excess of cardiac hypertrophy, and not to failure in compensation, and, as a consequence, that a cardiac depressant was indicated rather than a cardiac stimulant in the shape of digitalis. He was given from 1 to 2 minims (0.06-0.12) of the fluidextract of aconite three times a day, and during the continuance of this treatment was purposely confined to bed. At the end of a week so much improvement had taken place in his condition that he was allowed to rise and go about the ward as he wished, and after four weeks, the medicine being continued during this period, he was so improved that he was discharged from the hospital, with no other evidence of cardiac disorder that physical examination would show.

In some instances tincture of veratum viride, 5 to 10 minims (0.3–0.65) does better than aconite.

Great care must be taken to differentiate the overaction of the heart, when feeble and dilated, from the overaction of excessive hypertrophy, the more so as the former is the state more frequently met with. If this is not done serious damage may result. An ice-bag over the heart is often all that is necessary, in addition to rest, to quiet this viscus.

Fatty heart occurs in two forms: that in which true fatty degeneration has taken place in the muscular fiber, and that in which there is a deposit of fat about the heart and between its fibers. Nothing of any importance can be done for the first state, except by the use of nitroglycerin or by the iodides to relieve arterial tension if it be too high. Nux vomica and morphine may be useful to relieve symptoms of cardiac distress. Much can be done for the second form. In neither form is digitalis of much value. If given it should be combined with nux vomica, or nux vomica may be given alone in full doses. The patient suffering from the second form of heart trouble is nearly always obese, and should abstain from fats and rich foods, from all sweet wines and malt liquors, from sugars and milk, and at the same time take exercise. At first this treatment may cause dyspnea, but by gradually increasing the severity of the exercise much can generally be effected in the end, with marked improvement in the cardiac action. (See Obesity.)

Heart disease, associated with failure of the muscle, may not only be treated with drugs, but with other remedial measures, such as gentle, active exercise, passive exercise, and baths, the latter being given with care to avoid too great shock and for the purpose of improving the general circulation.

The exercises are so-called resistance movements, the patient slowly flexing and straightening his limbs and neck against gentle resistance on the part of an attendant. By this means the circulation of blood and lymph in the tissues is aided without tiring the heart. These resistance exercises do not, however, agree with all cases. In persons with very feeble hearts gentle massage is far better. The rule should be never to give enough exercise or massage to cause acceleration of the respiration or marked increase in the action of the heart. Very feeble cases should have the massage at the first period of the treatment, the exercise next.

HEMORRHAGE.

(*Including Menorrhagia, Metrorrhagia, Hemoptysis, Hematemesis, Intestinal Hemorrhage, Hematuria, and Post-partum Hemorrhage.*)

Under this heading will be considered all forms of hemorrhage which we may endeavor to control by drugs or measures not directly surgical in their scope, with the exception of epistaxis, which has already been spoken of.

Whenever a hemorrhage can be arrested by the application of a ligature or by compression, as in a cut of the finger or some similar wound, no styptic should be used. Styptics are employed for the double purpose of constringing the tissues and coagulating the blood, and, in consequence, form coagula which tend to make a septic mass about the wound. Where the bleeding point cannot be reached by direct compression, or for ligation, the use of packing with aseptic gauze is advisable, but substances supposed to increase the coagulability of the blood are not needed unless the coagulation is unduly slow. If these measures fail to control the bleeding then torsion or ligation of the bleeding vessel becomes necessary.

In all forms of hemorrhage in which the flow has been sufficiently great to endanger the patient's life, resort should be had to hypodermoclysis, intravenous injection or to transfusion. (See Hypodermoclysis, Intravenous Injections, and Transfusion, Part III.)

In cases in which there is reason to believe that the hemorrhage continues because of diminished coagulability of the blood, particularly in *hemorrhage in the new-born* and in *jaundice*, a hypodermic injection of fresh blood serum from a healthy adult should be resorted to, to provide the ferment needful for coagulation. An ounce (30.0) repeated every day for several days is usually the amount required. (See Hemostatic Serum, Part III and Parathyroid Gland, Part II.)

Menorrhagia is an excessive flow of menstrual blood, either excessive in quantity during two or three days or continuing an unusual number of days; while *metrorrhagia* is a state in which bleeding takes place from the uterus independently of menstruation and at any period of the month, or even after the menopause has occurred.

Menorrhagia is not to be determined by the amount of the flow, but by whether the loss is sufficient to cause ill health or to indicate disease. In some cases it is a means of relieving plethora.

No drugs should be prescribed for menorrhagia or metrorrhagia except in an emergency without first determining the cause of the bleeding. It is only by following such a rule that one can avoid harm to the patient suffering from one of the complications of pregnancy, and it will be only by following this rule that one will avoid overlooking an early carcinoma of the genital tract.

When the physician decides that something should be done to improve the condition of the patient, when suffering from either menorrhagia or metrorrhagia, it is necessary for him to find out whether a polypus, fibroid growth, endometritis, carcinoma, or other form of uterine disease is directly responsible for the trouble, and in the meantime to employ drugs known to act favorably upon uterine hemorrhage. The most prominent of these drugs are ergot, cotarnine, and oil of erigeron, the first and second being the best for active bleeding, the second and third for oozing and for cases where there is a continual "show." Cotarnine hydrochloride is given in pill or capsule in the dose of 1 to 4 grains four times a day. The fluidextract of ergot may be given in varying dose, from 10 to 60 minims (0.6–4.0), according to the necessities of the case, and the oil of erigeron in capsule in the dose of from 3 to 5 minims (0.2–0.3), or, if capsules cannot be had, the physician may employ the oil in an emulsion made by using syrup of acacia or other similar substance.

If these remedies fail curettage may be needful and the use of radium, by one skilled in its use, is to be resorted to, remembering, however, that its use prior to the menopause will probably make the woman sterile.

Where menstruation is irregular and the menorrhagia is almost a metrorrhagia, bromide of potassium or sodium in the dose of 10 grains (0.6) several times a day is often very serviceable. Cannabis, if an active sample is obtainable, is also said to be of service, but the writer has never used it to any extent. Oil of cinnamon, in the dose of $\frac{1}{2}$ dram (2.0) is said to be efficacious in the slow oozing of some cases where erigeron cannot be used or obtained. Sometimes, where congestion of the pelvic viscera is the cause of the trouble, dry cups over the sacrum give relief. Often, however, the case is purely surgical.

Hemoptysis, or hemorrhage from the lung, is usually due to tubercular ulceration of a small or large bloodvessel or to mitral disease, and the life of the patient depends more upon the rapidity with which a clot naturally forms than upon the skill of the physician.

Hemorrhage from the lung must be regarded as any other hemorrhage. The object of the physician is not to stimulate the heart and vasomotor system, thereby increasing the leakage from the bleeding vessel, but to lower the arterial pressure to as low a point as is safe. With this end in view nitroglycerin may be given hypodermically in the dose of $\frac{1}{100}$ to $\frac{1}{50}$ of a grain (0.0006–0.0014) or 5 minims of amyl nitrite may be inhaled. If these drugs are not obtainable, chloroform may be given by inhalation with care, to lower blood-pressure and quiet the overacting heart. (See Amyl Nitrite.)

The rule to follow is best stated as follows, if the hemorrhage has been severe and the patient is feeble: Place the head lower than the feet and apply Esmarch bandages to the limbs to keep the blood in the vital parts as much as possible. The use of stimulants can only increase the hemorrhage by increasing the pumping power of the heart and by dislodging the clot from the eroded bloodvessel.

Daremburg and Yeo have employed ice or ice-cold compresses to the scrotum or vulva in cases of hemoptysis, and claim good results from this use of cold. Cold must not be used if the patient is very feeble.

To allay nervous excitement and cough a hypodermic injection of morphine should be used. Chloral and the bromides are often useful remedies for this purpose, and should be given by the mouth, or, if vomiting is present, they should be given by the rectum, dissolved in starch-water. (See Chloral and Bromides.)

Though text-books order atomized solutions to be inhaled and other remedies to be taken by way of the lung, in most cases these measures will be found impracticable, because the nervousness of the patient and the constant cough will not permit of inhalations to any extent, and even if a full breath can be taken, it generally increases the bleeding and coughing.

In cases where severe or repeated hemoptysis develops it may be necessary to resort to artificial pneumothorax. (See Tuberculosis.)

After an attack of hemoptysis there is great danger in many cases of a traumatic pneumonia being set up by the presence of the extravasated blood. This should be combated by the use of a carefully regulated diet, and the reduction of any arterial excitement by small doses of aconite in persons *not weakened by advanced disease or by the bleeding.* Complete rest in bed is to be insisted on, and no stimulants allowed in food or drink unless the weakness of the patient requires them.

Hematemesis.—This depends either upon some injury to the stomach, or, much more commonly, upon gastric ulcer, cancer, or cirrhosis of the liver, and is one of the easier of the so-called "internal hemorrhages" to treat, because by ordering the patient to swallow styptic drugs we can act directly upon the bleeding surface.[1] Adrenalin in the dose of 1 dram (4.0) of 1 to 1000 solution may be given. Morphine may be used hypodermically to produce general and gastric rest and to aid the formation of a clot. Bandages to the extremities and external heat should be applied if the hemorrhage is sufficiently great to cause faintness. (See Gastric Ulcer.)

Hemorrhage from the bowel is to be treated according to its point of origin. If it be from the colon or rectum or from hemorrhoids, treatment must be by way of the anus. In any case rest in bed is essential. If it be from the duodenum as soon as the patient recovers from the hemorrhage relief from the duodenal ulcer by surgical measures should be resorted to. (See Gastric and Duodenal Ulcer.)

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[1] Hematemesis also ensues as a result of swallowing blood which has escaped into the mouth or nasopharynx, and this symptom is sometimes induced by malingerers in order to further their ends. These forms of hematemesis should, of course, be separated from those dependent upon some lesion in the stomach itself.

Hemorrhage from the bowel is best combated by the hypodermic use of morphine, and a small ice-bag to the belly if the patient is not in collapse. No remedy given by the mouth, or hypodermically, has any direct effect in intestinal bleeding, except there be delayed coagulation-time. (See Hemostatic Serum.)

Where the hemorrhage is dependent upon ulceration of the colon, rectum injections are to be resorted to. These are both styptic and curative, the styptic injections being particularly useful when the bleeding is to be stopped at once, the others where it is sought to remove the condition producing the trouble.

To the first class belong alum, sulphate of copper, Monsel's solution, sulphate of iron, tannic acid, and cold water. In the second, we find nitrate of silver, and the sulphates of copper and iron.

The alum solution used should be fairly strong, 10 grains to the ounce (0.6–30.0); the copper, 5 grains to the ounce (0.3–30.0); the Monsel salt, 10 grains to the ounce (0.6–30.0); or ½ to 1 dram of Monsel's solution to each 2 ounces (2.0–4.0 to 60.0) of water. The tannic acid should be used in the strength of 20 grains to 1 ounce (1.3–30.0) of water and glycerin. Another useful drug, if the site of the hemorrhage can be reached, is adrenalin chloride in the proportion of 4 drams of the ordinary 1 to 1000 solution in ½ pint of normal saline solution.

These injections should be carefully given, and the success or failure attending the treatment of these states depends as much upon the *technique* of the operation as upon the particular medicinal substance employed. It should never be forgotten that an injection designed for local medication should be as small in bulk as circumstances will permit. Thus, in inflammation of the rectum the amount of the injected liquid should not be above 4 ounces (120.0) at the utmost, and preferably 2 ounces (60.0) unless the diseased area is high up. An enema is given in bulk so as to cause distention and excite the bowel to movement, whereas from a medicinal injection no movement is desired. (See Enteroclysis, Part III.)

In *melena neonatorum* or in the bleedings of *hemophilia,* the injection of human serum, horse serum, hemostatic serum, or transfusion are to be utilized. (See Transfusion.)

Hematuria is a condition in which blood appears in the urine, and may be divided into two classes: that in which the blood comes from the kidney or bladder, and that in which it comes from the urethra. In the first class the blood is always well mixed with the urine, which is changed in color from its decomposition, and the blood is present either during the entire act of urination or just at the end of the act. In those instances in which the blood is in the first part of the stream it arises in the urethra, is nearly pure, and not well mixed with the urine.

If the hemorrhage is alarming, injections of adrenalin chloride (1 to 5000) may be used; or astringent washes, such as 2 or 3 grains of alum to 1 ounce of water, may be injected into the bladder. It must be remembered, however, that alum fills the bladder with clots, which are not readily passed and are liable to become septic.

Malarial infection is sometimes accompanied by hematuria or hemoglobinuria. The cause is obscure, and an immense amount of discussion has taken place as to its proper treatment. Many physicians assert that the use of quinine in these cases produces disastrous results; others claim that the drug is most valuable. The value of quinine consists, undoubtedly, in its ability to prevent other attacks, rather than to relieve that already present or its result—the hematuria. If an examination of the blood shows the presence of the estivo-autumnal parasite, quinine is to be freely used; but if not, it is to be avoided. Personally the author believes that malarial hematuria and hemoglobinuria will ultimately be found to depend upon very different causes. In some cases it will be found that the malarial parasite is the cause of the disease. In other instances it will probably be discovered that an entirely different organism belonging to the same general type of the parasites is responsible for the development of this dangerous and much dreaded complication. (See Cinchona, Part II.) Sodium thiosulphate is a most useful remedy in malarial hematuria in the dose of 5 to 15 grains (0.3–1.0) every five hours. Many practitioners use as much as a dram of thiosulphate of sodium every two hours until purgation takes place, give morphine and atropine hypodermically to relieve pain and quiet the stomach, apply cups over the kidneys, and give large amounts of water so as to freely flush the kidneys.

Postpartum hemorrhage is to be controlled by the use of abdominal friction and kneading or grasping the dilated uterus through the relaxed abdominal wall; by the use of dram doses of the fluidextract of ergot, or by the hypodermic use of 15 minims (1.0) of pituitrin or of "Ergot Aseptic;" or by irritation of the uterine wall by passing the hand, covered by an aseptic rubber glove, up through the vagina into the uterine cavity. In other cases irrigation with sterile water as hot as can be borne may be resorted to. (See Puerperal Diseases.)

In all forms of oozing hemorrhage from small vessels adrenalin chloride is to be thought of as a local application, or horse or human serum, given hypodermically or applied locally. (See Ceanothyn, Part II.)

HEMORRHOIDS.

Hemorrhoids are vascular dilatations of capillaries, arteries, or venules situated outside or inside of the sphincter ani, or are composed, in the case of what are called external piles, of tags of skin which are more or less vascular and become troublesome when inflamed.

The internal pile if large, is apt to prolapse and to become strangulated by the sphincter muscle. It is covered with mucous membrane, and is sometimes very small or like a mulberry in shape, consisting of a tuft of capillaries, a loop of an arteriole, or of a venule. The capillary or arterial hemorrhoid is apt to be bright red, and to bleed profusely when touched or when scraped by hard feces. The venous tuft also bleeds, but not so freely, and the blood is not so bright in color. In cases in which the hemorrhoids "come down"——that is, pass out through the anus, so being in danger of becoming strangulated—the protruding mass should be washed with cold water thereby at once cleansing it and reducing its congestion, and then gently pushed back with the fingers, which should be well oiled. In some cases it is advantageous to push gently into the rectum a cold rectal dilator, which will not only replace the piles, but also contract their walls and displace the blood with which they are filled. Care should be taken that an external hemorrhoid is not mistaken for an internal pile, since if an external growth is pushed through the sphincter it also becomes strangulated.

The treatment of internal hemorrhoids is to a great extent identical with that of the external variety. A suppository may be used, made up as follows, if there is a tendency to slight hemorrhage:

℞—Acidi gallici	gr. xx (1,3)
Extracti opii	gr. j (0.06)
Extracti belladonnæ foliorum	gr. ij (0.12)
Olei theobromatis	q. s.—M.

Fiant suppositoriæ, No. x.
S.—Use one every night.

In place of this, distilled witch-hazel extract may be injected into the rectum in the quantity of 1 to 2 ounces (30.0-60.0).

If the hemorrhage is profuse, the physician should use a speculum, find the bleeding-point, and touch it with strong nitric acid, followed by the suppository named above. If this is done, the bowels should be confined for some days until the spot under the slough made by the acid can heal.

If the prolapsed hemorrhoid is inflamed and difficult of reduction the following ointment of Mathews may be ordered:

℞—Cocainæ	gr. xij (0.8)
Iodoformi	ʒj (4.0)
Extracti opii	gr. xxx (2.0)
Petrolati	℥j (30.0).—M.

S.—Use as a salve.

Note that this prescription calls for cocaine, not cocaine hydrochloride. The reason for this is that the salt of cocaine does not act well when mixed in an ointment.

If the pile still refuses to be reduced, place the patient in bed and apply a hot compress wet with adrenalin chloride solution (1:2000). If this fails, operation is demanded. The pile should be incised and the clot turned out.

The treatment of external piles themselves consists in the maintenance of the most rigid cleanliness Immediately after each movement the parts should be thoroughly washed by means of a sponge dipped in cold water, or, better still, by the use of the bidet or a nozzle attached to a fountain syringe or to the general water-supply. (See Cold, Part III.) After they are thoroughly cleansed, it is well to bathe them with distilled extract of hamamelis. Often it is advisable to precede the regular daily evacuation by a rectal injection of sweet oil to soften the feces, and, more important still, to decrease congestion. If the inflammation of the external piles is very acute, the patient should be placed in bed and the cold injections frequently repeated or hot compresses applied to the anus. After this a lotion of lead-water and laudanum—laudanum f℥ ss (15.0) to dilute lead-water f℥ ij (60.0) may be used.

If in association with the presence of hemorrhoids there is much itching the following salve may be applied:

℞—Mentholis	gr. xx
Hydrargyri chloridi mitis	gr. xxx
Petrolati	℥j (30).—M.

S.—Apply locally.

The injection of phenol into hemorrhoids is a questionable practice, and if employed only 1 drop is to be used.

In addition to these applications there are important general rules to be observed.

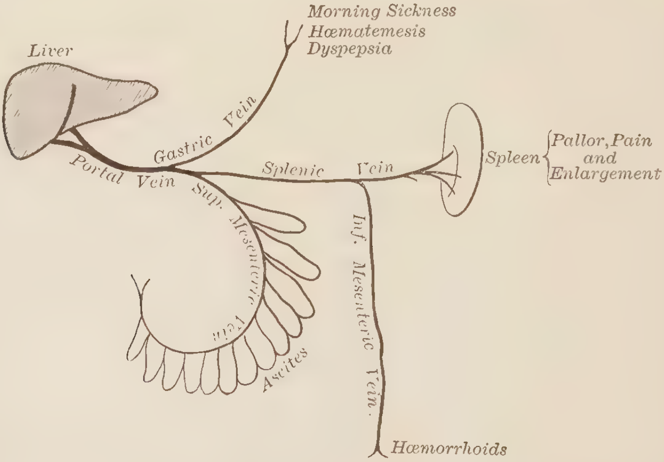
Morning Sickness
Hæmatemesis
Dyspepsia
Liver
Gastric Vein
Portal Vein
Splenic Vein
Spleen
Pallor, Pain and Enlargement
Sup. Mesenteric Vein
Ascites
Inf. Mesenteric Vein.
Hæmorrhoids

FIG. 125.—Showing connection between bloodvessels of liver and hemorrhoidal plexus. (Seymour Taylor.)

The patient's habits should be so arranged that the daily act of defecation is at night before going to bed, rather than in the morning, as under these circumstances the rest in bed relieves congestion and soreness, which the maintenance of the erect posture might aggravate. Plethoric individuals should not use upholstered chairs, as the heat of the body relaxes the rectal tissues. A cane-seated chair is best, or an air-cushion with a hollow center. The liver plays a most important part in relation to hemorrhoids, and, if it is congested, congestion of the hemorrhoidal veins is very apt to ensue. The connection between the liver and the hemorrhoidal plexus is most intimate, since this plexus is formed by the superior hemorrhoidal veins, which are branches of the inferior mesenteric, and the middle and inferior hemorrhoidal veins, which terminate in the internal iliac. The portal venous system is composed in part of the inferior mesenteric vein, and any obstruction to venous flow in the liver at once results in engorgement of the hemorrhoidal plexus.

(For the surgical treatment of piles reference must be made to surgical works.)

HICCOUGH.

Hiccough is an affection arising from many causes, depending upon irritability of the nerves supplying the diaphragm as a result of gastric irritation, after operations, uremia, and as a complication of several exhausting diseases, such, for example, as typhoid fever.

The mechanism of its production rests upon the sudden contraction or descent of the diaphragm, whereby a vacuum is formed in the chest into which the outside air attempts to rush, but is prevented from doing so by a sudden closure of the glottis, the peculiar sound of the hiccough being thus developed. Generally the symptom stops of itself, but it may become continuous and excessive.

The remedies to be employed are used according to the cause of the disorder. If there be gastric or intestinal irritation, the irritating matter must be removed by lavage or purges, and nervous and local sedatives used. A dram (4.0) of spirit of chloroform does good in many cases, and tincture of capsicum may be employed in other instances, say 5 to 10 minims (0.3-0.6) well diluted. Spirit of camphor, or the tincture of valerian, in the dose of 1 dram (4.0), may be serviceable, and Hoffmann's anodyne is peculiarly efficacious in the dose of 1 dram (4.0) in ice-water. In the hiccough of typhoid fever nothing compares to musk, 20 grains (1.3) by the rectum, and, if this cannot be used, oil of amber may be given by the mouth in the dose of 5 to 10 minims (0.3–0.6) in capsule or emulsion, and followed by a drink of milk to prevent irritation of the stomach. Ether, given hypodermically, is useful. When hiccough is so persistent as to endanger life it must be controlled by the use of bromide of sodium and tincture of opium given by the bowel. (See article on Vomiting for directions; also see Chloretone.)

Carbon dioxide gas and oxygen is a valuable remedy, 5 to 10 per cent CO_2. Tanks of CO_2 and oxygen in these proportions are now available and the gases delivered through a nasal tube or by an inhaler. The inhalation lasts five to fifteen minutes. If heavy breathing comes on and the patient is feeble the amount of CO_2 is cut down or the oxygen increased, or the inhalation is stopped for a time. The percentage of CO_2 given with oxygen or with air is about 5 per cent. (See Carbon Dioxide, Part II.)

Sometimes washing out the stomach with a stomach tube is useful.

Where external remedies are resorted to, ether thrown in a fine spray on the epigastrium may check an attack.

Sometimes making the patient sneeze by means of snuff or tickling the nostril with a feather will stop a paroxysm.

In cases where the affection comes on after meals and is due to indigestion, a course of tonic treatment will often give relief. Thus nux vomica in pill or tincture, accompanied by some dilute mineral acid, such as hydrochloric or nitric, may be employed, or, if the stomach is acid—

℞.—Sodii bicarbonatis . . . . ℥j (30.0)
Magnesii carbonatis . . . . ℥j (30.0).—M.
S.—Teaspoonful (4.0) in water as needed.

If the symptoms are due to uremia, a hot pack may be found of service, unless contraindicated by advanced depression and systemic weakness. Even in the presence of these symptoms it may be advisable to resort to this measure, protecting the patient against depression by a hypodermic injection of strychnine.

HIRSUTIES.

Superfluous hairs when single may be removed by forceps. When numerous they are often removed by shaving, but this results in their speedy regrowth. They can also be removed by electrolysis, inserting a fine needle of some non-corrosive metal in the hair follicle when attached to the negative pole of the galvanic battery. This is laborious, requires many treatments, and may cause puckering if the skin is delicate. Pusey recommends the use of an epilating wax composed of 1 part by weight of beeswax and 4 parts of rosin. Melt the wax with a low heat and when fluid add the rosin and stir into a homogeneous fluid. Pour into a greased dish and divide into squares with a greased knife as the mixture cools. When used a square is softened by gentle heating and then pressed firmly over the hairy area by a moistened thumb. After the mass is hardened it is pulled off with a quick jerk in the direction opposite the growth of the hair. Pusey claims this is not painful. Any wax which may stick to the skin may be removed by carbon tetrachloride.

INCONTINENCE OF URINE.

Incontinence of urine may be classified either according to its forms or the methods of its treatment.

Four varieties may be recognized as occurring separately, although all of them may occur in one case. There are cases where the bladder fails to hold the urine day or night, those in which the incontinence is only nocturnal, and those in which it occurs only upon some nervous start or in which the sphincter becomes relaxed from general atony. The first of these occurs in children, the last in adult females. A fourth form of incontinence depends upon paralysis arising from centric nervous disorder or from paralysis due to retention and consequent paralytic distention.

Taking up the consideration of the first forms—namely, those occurring in children, in which the trouble is generally nocturnal—the complete history and the present condition of the case must be discovered. Many of the most obstinate cases will yield when the urine is made constantly clear and mild by the use of alkalies, and others will recover upon the removal of worms from the vagina, which have crawled there from the rectum, or upon circumcision of a redundant prepuce, particularly if this be tight and smegma and urine be found back of it in large or small quantity. The cause of the incontinence in both these conditions is reflex irritation of the bladder-walls, by irritation at the end of the penis or in the vagina, and the reason that alkalies do good is that they render the urine, when concentrated and irritating, dilute, alkaline, and mild. Belladonna in these cases is rarely, if ever, curative, and is at most only palliative, the condition returning as soon as the passing off of the effects of the drug permits the irritation to be felt by the nerves of the bladder. After alkaline diuretics have been used belladonna is, however, very valuable Where the urine is acid, concentrated, and dark in color the following prescription is always useful:

℞—Potassii citratis . . . . ʒij (8.0)
Aquæ destillatæ . . . . q. s. ad f℥iij (90.0).—M.
S.—Dessertspoonful (8.0) every four hours in a tablespoonful (15.0) of water.

As the urine becomes clear after several days a few drops of tincture of belladonna may be added to the dose; but if a moderate amount is not sufficient, it must not be increased, as belladonna will not cure the condition, and may make the urine concentrated—a condition directly opposed to that which is wanted.

In other instances—and these are by no means rare—the urine is concentrated and ammoniacal in odor. Under these circumstances one of three drugs may be used with advantage, namely methenamine (urotropin or uritone) in the dose of 4 grains (0.25) in ½ glass of water three times a day; or benzoate of ammonium, given in the same quantity in syrup after meals, or bitartrate of potassium. All of these drugs acidify the urine and render it antiseptic, and for obvious reasons are harmful if the urine is already acid.

Sometimes these cases are dependent not so much upon vesical irritability as upon weakness of the spinal centers governing the bladder. If this be the case the urine should first be rendered mild, and then remedies should be directed to the improvement of these parts. The following pill or the succeeding solution should be administered:

℞—Arseni trioxidi . . . . gr. ¼ (0.023)
Extracti nucis vomicæ . . . . gr. ij (0.12).—M.
Fiant pilulæ, No. xx.
S.—One three times daily after meals for a child of eight or ten years.

Or,

℞—Liquoris potassii arsenitis . . . . ♏xxiv (1.5)
Tincturæ nucis vomicæ . . . . ♏xxiv (1.5)
Aquæ destillatæ . . . . q. s. ad f℥iij (90.0).—M.
S.—Shake well. Teaspoonful (4.0) three times daily for a child of eight or ten years.

This mixture is so bitter as to be disagreeable, and Fowler's solution may often be used alone in the dose of ½ to 1 minim (0.03–0.06), and at the same time strychnine in gelatin- or sugar-coated pill or granule may be given.

It must be remembered that this last treatment is only to be employed in chronic cases devoid of all irritation and dependent upon atony. It will not do good if the urine is not previously made clear.

Nothing can be more unfortunate in the treatment of these cases than punishment by severe scolding or whipping the child, as it never does good, and, the fault being beyond the child's control, the unjust punishment makes him sullen, or through nervousness, augmented by such treatment, his trouble becomes worse. In some cases it may be necessary, in order to cure the habit, to let the child drink diuretic waters for years. The patient should always be taken from bed when the parents retire for the night and made to evacuate the bladder.

For the incontinence of adult females or males due to atony of the vesical sphincter, and which occurs on laughing or sudden movement, nothing compares, from a curative point of view, to drop doses of tincture of cantharides three or four times a day, the urine being kept flowing freely from the kidneys by means of alkaline diuretics. Attention to the reaction of the urine in these cases is also of value. If it is acid, alkalies must be given; and if alkaline, methenamine is indicated.

The treatment of the fourth form of incontinence of urine comes into the province of surgery. The bladder must be relieved by the catheter if the trouble be from retention with distention, but it is unwise to completely evacuate it at once. If the disorder is due to paralysis nothing can be done except to carry out those general measures valuable in such cases—to maintain the urine in as normal a state as possible by urinary antiseptics, to catheterize frequently with an aseptic catheter, and to wash out the bladder every few days or hours, as the case may be, with some weak antiseptic fluid, such as the 1 to 10,000 solution of bichloride of mercury, or 1 to 200 of phenol, or 1 to 100 of boric acid, or 1 to 500 potassium permanganate.

INDIGESTION (GASTRIC AND INTESTINAL).

Under the heading "Biliousness" the writer has described many of the conditions arising out of indigestion, and, this being the case, the consideration of that symptomatic state known as dyspepsia or indigestion will only receive attention at this point.

Any patient who has chronic indigestion is to be carefully examined for definite organic disease of the stomach, gall-bladder, or duodenum before the physician is justified in considering the condition purely functional.

Lack of *gastric* digestion depends for its existence upon a great number of causes, and is always a symptom, not a disease. It occurs during the course of short or prolonged fevers from atony of the gastric walls and glands, from lack of secretion of the proper character, from hypersecretion of mucus by the mucous glands, or as the result of any one or all of these conditions, and lastly, because the food is unsuitable to the case, or is of a kind difficult of assimilation. Sometimes it is due to organic changes in the abdominal viscera, as carcinoma or ulcer, and sometimes to acute or chronic gastritis. In each of these states the treatment is, of course, different, because widely separated causative factors must be relieved.

The indigestion attendant upon the course of fevers can nearly always be avoided by a proper diet and the use of predigested food, such as pancreatized gruels, milk, or broths. The necessity of this artificial digestion is the more readily recognized when we recall the investigations of Hoppe-Seyler upon the quality of the gastric juice of a patient suffering from typhoid fever, for he found that no hydrochloric acid was present. Uffelmann has also found in a similar study that the peptone-forming secretion of the stomach ceases entirely during fever.

Where indigestion results from the presence of gastric catarrh the remedies applicable to such a state must be resorted to. (See Gastric Catarrh.)

The studies made within recent years upon the chemical conditions of the gastric contents have changed the methods of treatment from being empirical to being rational, for it is now known that disorders of digestion depend on deficient or excessive acidity of the gastric juice, deficient formation of pepsin, gastric ulcer, stenosis of the pylorus, deficient motility of the gastric walls, gastroptosis and enteroptosis and other less important causes. In other instances the presence of gall stones or cholecystitis leads the patient to believe that indigestion is present, as indeed it may be. Before carrying out any line of treatment the physician must, therefore decide, if possible, as to the underlying cause of the dyspepsia present in each case, and his decision may be based on well-described subjective symptoms by the patient, or upon this description aided, or it may be replaced, by examination of the stomach-contents after a "test-meal" by the fractional method, or the results of *x*-ray examination.

If enteroptosis is revealed by these means or if it is shown to be present by the physician standing behind the patient and lifting the abdominal contents to their normal level mechanical treatment is the first factor in the case. This usually consists in applying 2-inch zinc oxide adhesive strips from the middle line, beginning as low as the pubis, and running them up obliquely to the level of the kidneys or lower ribs as they leave the spine. Each strip should overlap the other and the anterior ends of the strips should overlap in front. If these prove successful the patient should wear permanently a light well-fitting belt several inches wide to hold the abdominal organs at the normal level.

In those cases in which the dyspeptic symptoms result from imperfect mastication and insalivation of food it is evident that careful rules about eating are to be given the patient, with the additional advice, which is equally good in all cases, that exact meal hours should be adhered to, since irregularity in meal hours results in imperfect digestion as commonly as irregularity of habit in regard to defecation results in constipation. If the dyspeptic symptoms are due to deficient secretion of gastric juice, particularly if it is found that hydrochloric acid is the chief deficient element, one or two plans presents itself for employment. In many cases it will be found that the administration of small doses of bicarbonate of sodium, 5 to 10 grains (0.3–0.6), before each meal will cause a free secretion of gastric juice, particularly if it be given simultaneously with bitter substances which act as stimulants to the gastric mucosa. These facts are not based solely on the apparent improvement in the patient, but also upon careful chemical studies of the acidity of the gastric juice by means of the stomach-tube. In mild cases the taking of a glass of imported Vichy water (Célestins) before each meal serves to provide sufficient sodium to produce good effects.

The bitter substances which it is best to employ in cases of deficient acidity of the gastric juice are among the simple bitters, such drugs as quassia, cardamoms, calumba, and gentian. Among the peculiar bitters we have nux vomica, quinine, rhubarb, and condurango. These may be employed in the following form:

℞—Sodii bicarbonatis	ʒiv (15.0)
Tincturæ nucis vomicæ	fʒj vel fʒij (4.0 vel 8.0)
Tincturæ gentianæ compositæ . q. s. ad	f℥iij (90.0).—M.

S.—Teaspoonful to a dessertspoonful (4.0–8.0) before meals.

When there is deficient gastric secretion through atrophy of the gastric tubules or carcinoma of the stomach, the use of hydrochloric acid is the better plan. Under these circumstances the following prescription may be ordered:

℞—Acidi hydrochlorici diluti		fʒj vel fʒiv (4.0–15.0)
Fluidextracti condurango		f℥j (30.0)
Tincturæ cardamomi compositæ	q. s. ad	f℥iij (90.0).—M.

S.—Dessertspoonful (8.0) with or after each meal in water.

The symptoms manifested by persons needing the treatment just named are variable, but generally of sufficient constancy in type to be fairly pathognomonic. There are generally loss of appetite, some impairment in general health and nutrition, and marked difficulty in digesting food, particularly if it be in solid form. Complaint is usually made of a sensation of weight after eating, without any real pain, but indigestion is not complete, owing to the food being finally disposed of in the duodenum. Often because of the delay in gastric digestion there is some belching of gas due to fermentation of the food in the presence of warmth and moisture, and without the antiseptic influence of the gastric juice. If any food is brought up with the belching, it is unaltered or changed only by fermentation. Examination of the stomach contents for hydrochloric acid will speedily confirm the diagnosis of absence of hydrochloric acid, and this confirmation should be sought for in every case. The use of hydrochloric acid is also of service, in that its presence in a free state causes the pylorus to open and permit the food to pass into the duodenum. When it enters the duodenum it indirectly aids digestion by causing the secretion into the blood of secretin, which in turn causes a secretion of pancreatic juice.

If much gas is developed and a sensation of weight in the stomach is felt after eating, so that the patient feels as if the food lay undigested in that organ, the following prescription may be used, but is contraindicated if the stomach is tender on deep palpation, or, in other words, if acute irritation or inflammation of the stomach is present. It is useful in atonic states of the stomach, and it is surprising how much relief may be afforded by the use in such cases of these prescriptions:

℞—Oleoresinæ capsici	♏ij (0.1)
Pepsini *vel* pancreatini	gr. xx (1.3)
Carbonis ligni	gr. xl (2.6)
Creosoti	♏x (0.6).—M.

Fiant pilulæ, No. xx.
S.—One after eating.

Another useful formula is:

℞—Pulveris capsici	gr. x (0.6)
Extracti nucis vomicæ	gr. v (0.3)
Taka-diastase	ʒij (8.0).—M.

Pone in capsulas, No. xx.
S.—One with meals.

In the cases of gastric indigestion depending upon hypersecretion of the acid of the juice a line of treatment quite at variance with that just discussed must be instituted. This may be divided into the direct and indirect forms, including the remedies which distinctly decrease gastric secretion and those which antagonize or overcome its acidity after it is poured out from the glands. In the first class we find both general and local nervous and glandular sedatives, and in the second alkaline drugs. Of the first class we have hyoscyamus, belladonna, and opium from the vegetable kingdom, and the bromides, bismuth, and nitrate of silver from the mineral. Of the second class we have massive doses of sodium bicarbonate taken during or after meals, ammonia, generally in the form of the aromatic spirit, and magnesia and chalk. (See Gastric Ulcer).

As many, if not all, of the cases suffering from hyperacidity are of a nervous temperament, these drugs do good by quieting reflex activity throughout the nervous system connected with digestion, and by a local action on peripheral nerves, or on the glands themselves, diminish secretion. Of particular value for this purpose is hyoscyamus, which very markedly decreases gastric secretion, directly and indirectly, and at the same time relieves gastric pain by its local sedative influence. The bromides in moderate doses are also useful. (See Magnesia, Part II.)

Taking gastric ulcer as a typical instance of a condition of excessive secretion of hydrochloric acid, it will be found that the following pill, combined with an absolute milk diet or, for the first few days, allowing only rectal alimentation by peptonized food, will be most useful:

℞—Argenti nitratis	gr. v (0.3)
Extracti hyoscyami	gr. x (0.6).—M.

Fiant pilulæ, No. xx.
S.—One pill one hour before taking food.

Sometimes in place of this pill it is wise, particularly if no ulcer exists, to give 10 to 20 grains (0.6–1.3) of bromide of strontium one hour before meals, and in any case where this fails to control excessive secretion of acid full doses of sodium bicarbonate may be given, 20 or 30 grains (1.3–2.0) or more, after each meal. The following formula may be used:

℞—Magnesiæ (hydrated)	ʒiiiss (14.0)
Bismuthi subnitratis	ʒiiss (10.0)
Cretæ preparatæ	ʒiiiss (14.0)
Sodii bicarbonatis	ʒiiiss (14.0).—M.

Fiant in chartulas, No. xx.
S.—One powder stirred in water three hours after meals.

When the bromides are given, it is best to give them in solution. If the stomach is very irritable and there is a tendency to vomiting, a powder composed as follows is often useful:

℞—Phenolis (cryst.)	gr. xx (1.3)
Bismuthi subnitratis	℥ss (15.0).—M.

Fiat in chartulas, No. xx.
S.—One t. i. d. with or before food.

The symptoms manifested by the patients requiring this treatment are as follows: There is often a constant sense of gnawing or hollowness in the stomach, which is sometimes temporarily allayed by the taking of food. The patient is, as a rule, of a nervous temperament and often in a condition of nervous depression due to some exhausting cause. Tenderness and even pain in the epigastrium may be produced by superficial or deep palpation, or the patient may complain that the pressure of her clothes is distressing. If ulcer of the stomach is present, all the characteristic symptoms of that lesion may be found. When belching occurs, there is often vomiting of sour masses or acid eructations or heartburn. Gastralgia more or less severe may also occur. Sometimes such patients are neurasthenic and need a rest-cure. (See Gastric Ulcer.) Duodenal ulcer or gall stones may be the cause of great acidity.

In cases where testing the stomach contents show that the excessive acidity is not due to hydrochloric acid, but to the acids of fermentation, the use of the sedative drugs named is of no avail, for obvious reasons, and in their place sodium bicarbonate should be employed as a palliative, and antiseptic or antifermentative drugs, such as thymol, beta-naphtol, creosote, chloral, and sodium thiosulphate, as direct remedial agents. Lavage of the stomach should also be resorted to. In still other cases a mixture containing chloral and thiosulphate of sodium is useful because of its antiseptic influence. (See Chloral.) In others relief will be obtained if the patient takes a teaspoonful of the following powder in hot water fifteen minutes before meals:

℞.—Sodii phosphatis exsiccati
Sodii bicarbonatis exsiccati
Sodii sulphatis exsiccati . . . . aa ℥ss (15.0)
S.—Teaspoonful in hot water sipped fifteen minutes before eating.

Often these cases are relieved if all fats are excluded from their diet-list.

Intestinal indigestion depends upon almost the same causes as does gastric dyspepsia, and is to be treated in much the same manner, chiefly by a careful study and regulation of the patient's diet, and by the use of a number of remedies calculated to aid to some extent the normal juices by some digestive ferment. These ferments should be given with the meals, or the food be "predigested" before it is taken. When the disturbance is due to imperfect digestion of the starches taka-diastase is useful. The presence of enteroptosis is always to be sought for.

The pancreatin should be given in full dose (5 to 10 grains [0.3-0.6]), with bicarbonate of sodium, and alkaline mineral waters used if the urine is concentrated and acid. (See Biliousness.)

Constant abdominal distress may be due to a diseased gall-bladder, a growth or to duodenal ulcer which demands surgical relief.

Sometimes when intestinal indigestion is present great flatulence comes on, and is an annoying symptom. Very commonly in these cases it will be found that the patients think they have heart disease because of the pain they suffer under the precordium. This pain is due to the accumulation of flatus in the small intestine, or more commonly to its pressing upward at the angle where the transverse colon turns to go down to form the descending colon and sigmoid flexure. Under these circumstances the prescriptions named above will be found of service, or the following may be used:

℞.—Extracti nucis vomicæ	gr. vi (0.4)
Asafœtidæ	ʒiss (6.0).—M.

Fiant pilulæ, No. xxx.
S.—One after meals, t. i. d.

In some persons flatulence of the large bowel is met with, and is often associated with atony of the muscular coats of the gut. Under these circumstances the following prescriptions will be found of service:

℞—Asafœtidæ	gr. xl (2.6)
Extracti nucis vomicæ	gr. iv (0.25)
Extracti physostigmatis	gr. iij (0.2)
Oleoresini capsici	♏x (0.6).—M.

Fiant pilulæ, No. xx.
S.—One pill three times a day, two hours after meals.

Or,

℞—Tincturæ belladonnæ foliorum	fʒiij (12.0)
Tincturæ physostigmatis	fʒiss (6.0)
Spiritus camphoræ q. s. ad	f℥iij (90.0).—M.

S.—Teaspoonful (4.0) two hours after meals or whenever needed.

Abdominal massage is a valuable aid in treating this class of cases. Sometimes it can be well done by directing the patient to roll slowly and gently a 3-pound cannon-ball over the course of the colon, to urge on the intestinal contents and cause secretion. In other instances the application of a roller electrode with the rapidly interrupted current from a faradic apparatus is useful.

Where intestinal indigestion results in lientery the treatment becomes entirely changed, except in regard to the use of a predigested milk diet, and efforts must be made to increase the secretion of the glands of the intestinal wall. Often minute doses of mercury bichloride or podophyllin may do this, $\frac{1}{60}$ to $\frac{1}{40}$ grain (0.001–0.0015) of the first or second, respectively. Sometimes a mixture with nitric acid will be the proper treatment, or perhaps the following if the liver is found to be torpid:

℞—Acidi nitrohydrochlorici (not dil.)	fʒss vel fʒj (2.0–4.0)
Tincturæ gentianæ compositæ q. s. ad	f℥vj (180.0).—M.

S.—Dessertspoonful (8.0) every four hours or after meals, in water.

Chloroform spirit is often valuable in some of these cases in the dose of 1 dram (4.0) in water. (See Chloroform.)

INFLUENZA.

The disease known as influenza affects individuals so differently, and presents so many symptoms associated with functional disorder of various organs in the body, that it is almost impossible to do more than consider the remedies which are to be employed in the treatment of the more frequent or more immediate manifestations or complications. Of far greater importance than the employment of drugs must be regarded continuous rest in bed, and stimulants are in many cases essential.

In those cases in which the disease is ushered in by a severe chill, accompanied by violent pains in the back and limbs, if the patient is seen early enough it may be necessary to employ remedies for the relief of the rigor, with the double purpose of improving the patient's general condition and preventing internal congestion of vital organs. In the majority of instances, however, the patient is not seen during this period of the disease, but during the febrile stage, which succeeds that just mentioned. Under these circumstances the author does not believe that it is well for the physician to resort to any of the remedies which have been so largely used during the last few years, and which are known as the "antipyretics" or the derivatives of coal-tar. Although originally introduced for the purpose of reducing febrile temperatures, practical experience has taught that their value is very limited under these circumstances, and the author never gives antipyrine, phenacetin, or acetanilid with the object of reducing fever. Although he does not believe that these remedies are to be used for the reduction of temperature, he has certainly seen very marked relief follow their employment with the object of subduing the severe pain which occurs in the back, limbs, or head. Small doses are usually sufficient at least to reduce the suffering, if not to remove it entirely, but, as cardiac complications are by no means unusual, large doses are contraindicated in most persons. The author prefers to allow the patient to suffer from a moderate degree of pain rather than from the dangers incident to the administration of doses large enough to relieve it entirely, because in his experience these doses have to be very large if they are to be entirely competent as analgesics in influenza.

A very useful recipe in these cases is a capsule containing 5 grains (0.3) of aspirin and 3 grains (0.2) of cinchonidine sulphate. One of these must be taken every three or four hours.

If any of the coal-tar products are used either for the relief of fever or of pain, phenacetin and acetanilid should be chosen. A favorite combination with practitioners who have had a large experience is one of phenyl salicylate (salol) and phenacetin. The action of the phenacetin in relieving the pain and in reducing the fever seems to point to it as a rational remedy, but the exact influence of phenyl salicylate under these circumstances is not so clear. Composed, as it is, of 60 per cent of salicylic acid and 40 per cent of phenol, it seems to possess a therapeutical power different from that possessed by either of these two constituents alone, for neither phenol nor salicylic acid has much power in the relief of pain when used alone. Perhaps the condition of pain in the lumbar and other muscles during the attack of influenza is in some unknown way associated with the condition which has been called "rheumatism," and in which salicylic acid does good in an unknown manner. Salicylic acid alone might be equally useful if it were dissolved in the intestine and did not irritate the stomach.

On seeing a case of influenza during the first few hours of the attack the author resorts to those remedies which have been in use by the profession for many years, and, so far, as he can learn, it is the custom of other members of the profession to give a mixture composed of spirit of nitrous ether and a solution of citrate of potassium in preference to any other medicine at this time. This mixture possesses the advantage of increasing the action of the skin and kidneys, and of reducing the temperature, of quieting the circulation, and of being readily taken by the patient without danger of disordering the stomach at this time or later, which is important as this organ is apt to become irritable. As a general rule, citrate of potassium is given in too small doses, and, unless there are reasons to the contrary, it should be given in the dose of 10 to 15 grains (0.6–1.0) three times a day to an adult.

If the fever becomes excessive, so that there is danger of the patient suffering from a true hyperpyrexia, it is better to resort to cool sponging with active friction instead of the antipyretics just spoken of. It is a very important portion of this treatment to use frictions designed to bring the heated blood to the surface. (See Cold and Fever.) If the patient is too feeble to react cold applications are contraindicated.

Hyperpyrexia in influenza does not seem to possess the same dangers that it does in the course of some other diseases. In the first place, as a general rule, the course of hyperpyrexia is very brief, and although it may leave the patient weak and exhausted, the duration of the febrile portion of the malady does not extend beyond a few days. Clinical experience and physiological study have proved that it is not the temperature of 105° or 106° F. which is distinctly dangerous, but the continuation of this temperature for many hours which is harmful. Similarly, a patient ill from typhoid fever, having a temperature of 103° for many days, is injured very much more than is a patient who is suffering from pneumonia, and who may have for forty-eight hours a temperature of 104.5° or 105° F. For these reasons a temperature of 104.5° or 105° F. is not particularly alarming in the condition which we are considering, unless there are symptoms pointing to the fact that the patient is being injured by an excessive temperature, as may be indicated by somnolence and an exceedingly dry skin as well as cerebral symptoms. The point to be strongly emphasized is that the mere existence of high temperature is not to be regarded as a condition to be overcome by the use of drugs.

It seems to be the general consensus of opinion, both in America and in England, that any measure of a *depleting* character are distinctly harmful in influenza, even at its earliest stages, and we would naturally expect that this would be the conclusion arrived at by physicians who treat their patients rationally. Although influenza is a short-lived disease, there is probably no malady in which the patient goes so quickly into a condition of profound depression, or even exhaustion, as in this one. The abstraction of blood from a vein or by the use of wet cups for the relief of pulmonary congestion should not be resorted to, as it will increase the exhaustion. Before the system has a chance to recover from the onset of the attack it will be still further depressed by the therapeutic measures of the physician if he is unwise enough to bleed.

As the case of influenza progresses a condition of marked depression, or even collapse, very frequently develops. The expression of anxiety on the patient's face is, to a physician who is accustomed to see it in other diseases, a most alarming symptom, and it is not until one has seen it repeatedly in influenza that he is able to give it its exact value. Associated with this condition, the skin is frequently covered with a profuse perspiration, and the pulse is apt to be very rapid, running, feeble, and easily compressed. At first glance the old saying, that "we treat the symptoms as they arise," would seem to cover to a very large extent the indications which are present at this period; yet the author's experience, which may differ from that of some of his readers, is that the cardiac stimulant which we are most frequently accustomed to use—namely, digitalis—does not seem to *take hold* of the circulatory apparatus and to act upon it in the manner which is desired. It may be that the pressing symptoms make us more anxious and impatient as to the use of any medicament, and that we do not have the patience to wait and allow such a slowly acting remedy as digitalis to take effect. Be this as it may, the author regards caffeine as infinitely preferable to fox glove when these symptoms appear; and he has been able to prevent their appearance, or at any rate to modify them to a very great extent, by using caffeine in full doses from the first portion of the stage of depression. As a general rule, caffeine is given in very much smaller doses than safety requires, and in many instances it fails to act because the doses are too small to combat the profound condition of exhaustion which is present. In an adult there is no reason why 3 grains (0.3) may not be given three or four times in twenty-four hours, and in some cases it may be given every four hours without producing any of the symptoms of an overdose. Divided doses are better than a few very large ones.

In the employment of strychnine in influenza, the author knows of no better illustration of the fact that in some conditions drugs should be given for *effect* rather than in customary dose, and the physician who is timorous in the presence of depression, certainly does not lessen the patient's danger. As with all powerful medicaments, the action of the drug should be carefully watched, and at the first manifestations of muscular twitching or stiffness at the back of the neck its administration should be cut down or discontinued. In many instances where the collapse comes on suddenly the strychnine should be administered hypodermically and followed by full doses by the mouth, in order to keep up the full effect upon the nervous and circulatory systems. In some cases it will be found that the bloodvessels seem to be so atonic that the strychnine is unable to produce a sufficient vascular effect to bring the patient out of his difficulties, and under these circumstances very good results follow the combination of atropine with strychnine, the atropine being a useful vasomotor stimulant under such circumstances. It also should be given in full doses for effect. As the acute stage of depression passes off the atropine should be stopped and the strychnine continued alone through convalescence. It is proper to point out, however, that strychnine is not suitable for the purpose of producing constant stimulation. It is a whip to the nervous system, and if used in too large a dose for too long a time the overwhipped system fags out. Under these circumstances it may cause an active delirium. Large doses should be used only for a day or two.

Alcohol has not seemed to be of much value during the active period of the disease. In milk-punches and egg-nog it is, of course, useful during convalescence.

When delirium comes on, it does not seem to be a symptom of very serious character either for immediate results or in influencing the prognosis as to the ultimate recovery of the case, and in cases of pneumonia complicating la grippe, in which delirium is the prominent symptom, it is not to be regarded in the same light as similar manifestations complicating ordinary pneumonia or other diseases. The delirium may be either talkative or muttering, but does not in the majority of cases require treatment, passing away with the fever and rarely extending into the stage of exhaustion. Morphine may be used as a sedative.

For the irritative cough steam inhalations, laden in the first stage with benzoin or other innocuous and sedative substances, seem particularly useful. For the bronchitis which is often present it is generally sufficient to administer the ordinary mixtures, containing ipecac and potassium citrate, in the earliest stages, and to follow them by chloride of ammonium or sandalwood oil in the later stages. The author does not think that the compound liquorice mixture containing antimony should be given in the second stage of influenza. A complication too apt to occur at this time is edema of the lung or a widespread bronchitis, with a profuse exudation which bids fair to drown the patient in his own secretions. Antimony is not only depressing to the circulatory and respiratory systems, but also aids very materially in causing the peculiar excess of secretion which has just been spoken of. (See Bronchitis.)

It may be necessary to use bromides if the cough is excessive, or to replace them by codeine or small doses of morphine. In many cases still better results will be obtained by a good preparation of cannabis, which may be pushed until it relieves the cough.

(For the treatment of pneumonia see Pneumonia and below.)

Vaccines have been largely used in prophylaxis. Their value is as yet uncertain. If possible a vaccine derived from the organisms producing the epidemic present should be employed as there seems to be reason for believing that it has a more specific effect.

Vaccines have also been largely used in the treatment of the attack. I do not think the results obtained justify this. Indeed, I believe that many cases are made worse by this procedure for the body is already so burdened with the infection that it fails to rally from the negative phase.

If sleeplessness is so pressing a symptom as to require attention, the bromides may be given, but it will be generally found that the insomnia comes after the attack rather than during it, or in any event it will not require attention until the patient is convalescent. Under these circumstances dial, or barbital sodium may be administered, care being taken that it is administered in a powdered form or dissolved in hot water and given one or two hours before the time at which sleep is desired.

For the vertigo and dizziness, which are sometimes bitterly complained of by the patient either during or after the attack, moderate doses of bromide of sodium with ergot or cannabis have seemed particularly valuable, probably because they exercise some effect upon the bloodvessels of the brain or its membranes or perhaps upon the bloodvessels of the ear. Certain it is that in those cases of tinnitus not associated with organic change in the aural canals bromides and ergot do more toward relieving them than any other medication.

In the constipation which is sometimes present in the early stages of influenza it is generally advisable to administer either castor oil or a bottle of the solution of citrate of magnesium. A full purgative effect of any of the salines seems to lessen the fever when the bowels are unloaded. Care should be taken that the dose of the purgative is not excessively large, as it will weaken the patient. For the constipation following the attack probably no drug is so efficient as cascara sagrada, combined perhaps with aloin. (See Constipation.) If diarrhea supplants the constipation, the ordinary astringents, such ar aromatic sulphuric acid and hematoxylon, will be found sufficiently active. (See Diarrhea.)

INSOMNIA.

Insomnia is a condition complicating many diseases, and arises from such a host of causes that the physician may not be able to discover them for some days after the patient is first seen. As a general rule, a patient consulting a physician with this symptom expects a prescription to be given at once and the cause of the insomnia found out afterward. Under these circumstances the physician may employ several drugs according to the information that he has concerning the patient's state.

A large number of remedies have been introduced as hypnotics, such as barbital, barbital sodium, paraldehyde, chloralamide, sulphonal, trional and others. Of these the best, from every point of view, are barbital, barbital sodium, dial and sulphonal. The dose of barbital and barbital sodium is 5 to 15 grains (0.3–0.6), best given in capsule or hot water, and of sulphonal the dose is 10 to 20 grains (0.6–1.3), but as it is large in bulk, it should be used in a prescription made up as follows:

℞—Sulphonal (sulphonmethani)		gr. xxx (2.0)
Syrupi		f ʒij (8.0)
Mucilaginis acaciæ		f ʒij (8.0)
Aquæ destillatæ	q. s. ad	f ℥j (30.0).—M.

S.—From half to all of this at one dose, as may be needed.

In other instances sulphonal may be dissolved in very hot water or milk, and the solution swallowed before it cools sufficiently to permit precipitation. One or two dial tablets are better.

One of the most common remedies is hydrated chloral given in the following manner:

℞—Chlorali hydrati		ʒiij (12.0)
Syrupi		f ʒiv (16.0)
Aquæ cinnamomi	q. s. ad	f ℥iij (90.0).—M.

S.—Dessertspoonful (8.0) at night.

Or,

℞—Butyl-chlorali hydrati	ʒj (4.0)

Fiant pilulæ, No. xii.
S.—One, two or three pills at night, as needed.

Where, for any reason, as the presence of a weak heart, chloral is contraindicated, resort may be had to the bromide of strontium, or sodium, and if the patient is a woman these drugs should always be accompanied by a small dose of arsenic, generally in the form of Fowler's solution, 1 to 3 minims (0.06–0.2) three times a day in order to avoid the possibility of the production of acne. The following prescription is useful:

℞—Strontii bromidi		ʒij vel ℥ss (8.0–16.0)
Liquoris potassii arsenitis		f ʒss (2.0)
Aquæ cinnamomi	q. s. ad	f ℥vj (180.0).—M.

S.—One or two dessertspoonfuls (8.0–15.0) at night.

In many cases larger amounts of the bromide will be needed.

Where the sleeplessness is due to pain, chloral is of little value and bromides are worthless. Under these circumstances by resorting to what is known as the "crossed action of drugs," we can often obtain a very good effect. Thus morphine and chloral both act on the brain to produce sleep, or, in other words, their action is here crossed, for one relieves pain and the other does not; one depresses the heart in overdose, the other depresses respiration; as a consequence, large doses of neither can be given alone. The following is therefore a useful combination, either where one drug fails or when dangerously large doses of either alone have to be used to obtain the desired result:

℞—Morphinæ sulphatis		gr. ij vel iv (0.12–0.25)
Chlorali hydrati		ʒij (8.0)
Syrupi		f℥ij (60.0)
Aquæ	q. s. ad	f℥iv (120.0).—M.

S.—Dessertspoonful (8.0) at night.

In cases where insomnia is due to mania hyoscine is very useful, particularly when combined with morphine, given in the dose of $\frac{1}{100}$ to $\frac{1}{90}$ grain (0.0006–0.0007) by the mouth or $\frac{1}{100}$ grain (0.0006) by the hypodermic needle. Owing to its tastelessness the powder may be put on the tongue, and it is best to order a little sugar of milk or white sugar (3 grains) to be added to each dose of hyoscine, in order to give it bulk.

When insomnia follows mental effort, avoidance of all cerebral activity should be insisted upon during the evening, and if the feet are cold on going to bed, sleep should be induced by relieving the cerebral congestion by a hot foot-bath or the use of a hot-water bag at the feet while cold is applied to the head. In other instances a general hot bath, during which an ice-bag is applied to the head, will produce sleep when drugs fail; and it is to be remembered that in the insomnia of convalescence and neurasthenia hydrotherapeutic measures are to be used to the exclusion of drugs (see Cold and Heat), for the former cure the condition, while the latter only palliate, and may produce a drug-habit.

Not infrequently patients convalescing from prolonged illness suffer from drowsiness during the day and wakefulness at night because the circulation is feeble and fails to supply the brain with blood while the body is erect, but does so very well when recumbent. Hydrotherapy to improve the vascular tone and the use of a pill of nux vomica and arsenic, or nux vomica and digitalis, is useful in these cases.

In ordinary nervous insomnia or that due to heart disease, chloretone often acts very efficaciously in the dose of 5 to 10 grains (0.3–0.6); in tablets or capsules of 3 to 5 grains (0.2–0.3) each.

Chloralamide (*Chloralformamidum*) sometimes does good in the dose of 15 to 60 grains (1.0–4.0), dissolved in wine or given in capsule. Paraldehyde is given in the dose of 20 to 60 minims (1.3–4.0). It is very apt to disorder the stomach, but it acts promptly. (See Part II.)

In the treatment of insomnia it should be remembered that if possible those drugs should be used which will quiet the part of the brain which is most active. Thus if the patient is restless, bromides and chloral should be used as motor depressants. If sensation is acute, bromides and the hot pack may be used as sensory quietants.

In some cases horseback exercise taken late in the afternoon does good, particularly if the patient follows a sedentary life. Care must be taken to avoid excessive fatigue. Many persons who are usually sleepless will obtain a refreshing slumber by taking a very light and easily digested meal just before retiring for the night or by eating a cracker or drinking a glass of milk when they awake during the night.

In some instance sleeplessness arises from acidity of the stomach, and is put aside by bicarbonate of sodium or magnesium carbonate.

INTERMITTENT AND REMITTENT FEVER.

It having been proved that malarial fever is always the result of the bite of a mosquito, the disease is to be prevented by removing mosquito-breeding pools and by protecting the skin. It is also important to prevent mosquitoes from biting a patient with malaria, as by this means the infection is spread. Such patients should sleep under a netting.

The diagnosis of "malaria" followed by the use of quinine has in the past been one of the abuses of medical practice. At present, even allowing for the unusual manifestations of this infection, the use of the microscope makes the diagnosis and the therapeutics sure. The diagnosis is, of course, clinical as well as microscopic and the special parasite in a given case is indicated by the symptoms as well as by the microscope.

The Tertian Parasite.—The tertian parasite clinically produces a sharp temperature rise introduced by a chill. This is followed by a sweat and a fall to normal or subnormal. The whole attack is usually over in eight hours and recurs, as the name of the parasite indicates, every second day. Microscopically this parasite is the largest of the three plasmodia. The *plasmodium vivax* is found in the peripheral blood in all its stages from the small rings to the adult sporulating organism. The red cells which are infected are strongly stippled and are large and swollen in appearance. The spores when set free are larger than the spores of the malignant form. The tertian parasite is always the most prevalent in the temperate zone.

The Quartan Parasite.—The quartan parasite (*Plasmodium malariæ*) clinically produces short, sharp attacks like the tertian; except, as its name indicates, the attacks occur every third day. The disease is usually mild in its manifestations but is more resistant to quinine and more prone to relapse than the ordinary tertian or malignant estivo-autumnal parasite. Microscopically it does not enlarge the corpuscles as does the tertian and the intracorpuscular movements of the parasite are not so marked.

The Estivo-autumnal or Malignant Tertian Parasite.—Clinically the rise of temperature may be as prompt but there is then a slight abortive fall followed by a rise so that the attack lasts eighteen to twenty hours instead of eight. The rigors are, as a rule, less marked than in ordinary tertian. The patient is manifestly severely ill (see below). Microscopically this organism (*Plasmodium falciparum*) is found in the peripheral blood only during the young or ring stage. The red cells which are involved are shrunken, not swollen, and have a metallic appearance and they are not stippled. Sporulation is not often seen as it does not take place in the peripheral blood but in the capillaries of the viscera. Repeated examinations may therefore be necessary to find the parasite.

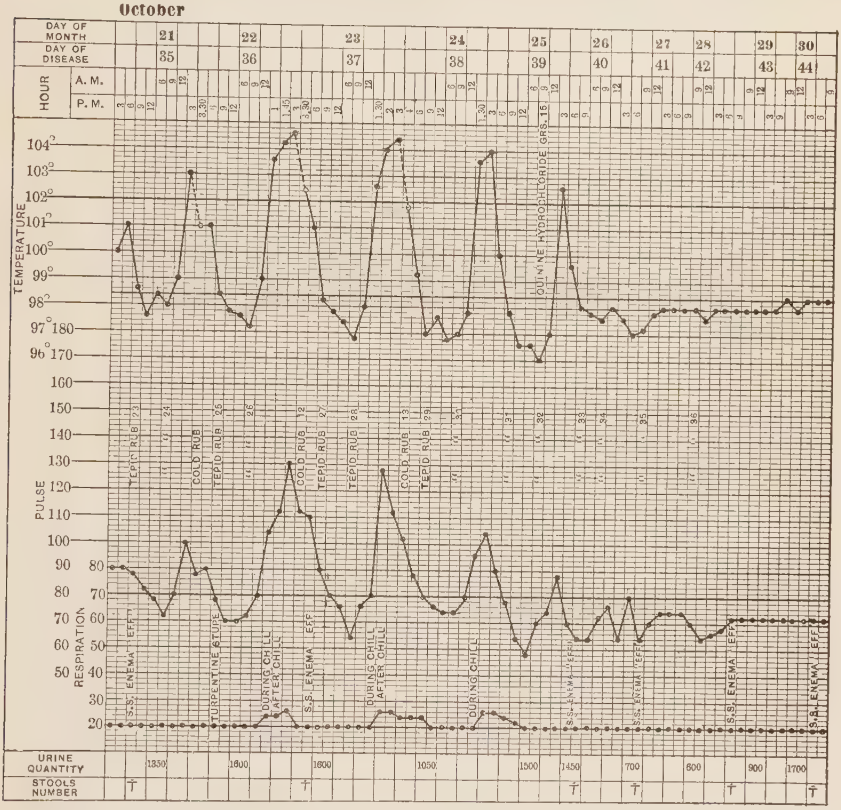

FIG. 126.—Typhoid fever convalescence complicated by malarial tertian parasite in blood. Cured by quinine.

Finally the examination of the white cells will give much valuable collateral diagnostic evidence. Thomson states that malaria is the only disease in which the leukocytes of the peripheral blood contain dark brown pigment granules and this is particularly true of the large mononuclear cells. There is a *relative* increase in the mononuclear cells particularly between the paroxysms, but there is a general leukopenia except when the comatose type of malignant infection is present, when there may be a leukocytosis of 100,000 (Thomson). A polymorphonuclear leukocytosis indicates no malaria unless there is an inflammatory complication. (For the changes produced in these parasites by quinine see Cinchona in Part II.)

In all forms of intermittent fever, whether the attacks are quotidian, tertian, or quartan, the best remedy for their prevention is quinine, which if given by the mouth should be administered about two or three hours before the attack is expected, so as to be absorbed and be active when sporulation takes place. This precaution is often overlooked, and the dose ordered at the time of the expected attack, with failure as a result. Not only should sufficient time elapse for absorption, but the fact should be remembered that the chill often begins an hour earlier each day, and will be in full sway before the quinine can stop it if the drug be not administered at the proper time.

Two methods of giving quinine in malaria have been employed. In one it is given just before an expected paroxysm, to prevent it by destroying the parasite at the time of maturity. In the other plan the drug has been administered in the sweating stage, not because it will have any valuable influence on that particular paroxysm—which is nearly over—but in order that it may destroy the young spores which are floating free in the blood stream and about to attack corpuscles, in which they will mature. Undoubtedly if the quinine is given at the proper time before an attack it tends not only to prevent the oncoming paroxysm, but also future ones by its influence upon the mature and immature parasites. If, therefore, the patient is seen before the attack, he should receive quinine to prevent or modify it. If seen after an attack is well advanced, he should receive the drug to prevent the next attack by destroying the crop of parasites set free in the blood during the paroxysm just passed.

In other words, quinine should be given freely daily until the infection is eradicated in order that any double infection may be overcome, that no immune parasites may be developed, and that the sexual form of the parasite, which does not produce a paroxysm but infects mosquitoes which spread the disease, may not develop.

It is to be remembered that quinine often fails to completely rid the body of the parasite and this seems particularly true of the parasite of tertian fever, the *plasmodium vivax.* For this reason quinine should be continuously given for two or three months after symptoms of malarial infection disappear, although gradually decreasing doses are usually all that is needful.

Experience has proved that quinine never acts as favorably if constipation is present as when the bowels are lax, and hepatic activity seems particularly necessary for its full effect. To obtain the full influence of the drug, it should be preceded, by some four or five hours, by 1 grain (0.06) of calomel every fifteen minutes until 5 grains (0.3) are taken, or by 5 or 10 grains (0.03–0.65) of blue mass, or by a dose of podophyllin amounting to $\frac{1}{10}$ to $\frac{1}{8}$ grain (0.006–0.008). If the podophyllin is used, a longer time should be allowed, because of the slow action of this purgative, and if the patient has been rendered unusually insensitive to purgatives, larger doses of both the remedies named must be used; particularly is this true in the hot climates, where 5 to 20 grains (0.3–1.3) of calomel are often used and really needed.

The dose of quinine varies with the exigencies of the case, which in turn generally depend upon the region in which the patient lives or has lived. If the patient remains in bed, smaller doses are needed than if he remains up and about; 10 to 15 grains (0.6–1.0) in one dose are often sufficient in the eastern and northern States, but as much as 20 to 45 (1.3–3.0) or even 60 grains (4.0) may be required in the southern and southwestern parts of the United States and elsewhere. Unless the condition is very grave, however, these amounts are best given in divided doses every few hours. The same dose is to be repeated daily until no parasites can be found in the blood, and if the attacks do not recur, it is wise to repeat the dose of quinine every week for several weeks to avoid relapse. Medication by the mouth may fail because of slow absorption or partial destruction of the drug in the liver. *It is important to remember that while small doses may seem to cure the patient by preventing sporulation and the development of chills and fever, they may not destroy those parasites which hide in the spleen and bone-marrow where they gradually become immune to quinine.* If the drug is stopped too soon they return to the blood stream, sporulate, and may be difficult to kill unless they are attacked by intramuscular or intravenous doses or by the use of arsphenamine.

It is noteworthy that no less an authority than Sir Ronald Ross advocates the use of about 8 grains a day in chronic malarial infection divided into four doses continued for at least as long as four months, even if the blood shows no parasites, because he believes single very large doses tend to overwhelm the body which hurries to eliminate them, with the result that many of the more deeply situated parasites escape the drug. In other words he advocates prolonged moderate doses rather than a few heroic ones.

When an immediate and certain effect is essential, quinine should be given intravenously. (For the best salts of quinine for intravenous use, see article on Cinchona.)

It must be remembered that the greater part of the harmful effect of the malarial poison is exerted at this time by the internal congestions and engorgement of the abdominal and thoracic organs. The physician should therefore try to prevent so far as possible too great a rigor; and if stasis results from the chill, overcome it, not by depletants, but by stimulants, such as strychnine or digitalis, which will drive out the blood from the congested area.

If a full meal has just been eaten, the stomach should be emptied by an emetic dose of ipecac, 2 drams (8.0) of the powdered drug to an adult, or by $\frac{1}{6}$ grain (0.006) of apomorphine. It is almost useless to give quinine at this time, as absorption from the stomach and subcutaneous tissues is almost entirely absent. Alcoholic stimulants are not to be employed, as clinical experience seems to indicate that they do not act favorably.

If the chill is severe enough to endanger the patient's life, measures must be used to control it. Chloroform may be inhaled, and immediately preceded by laudanum by the bowel or mouth. If the laudanum is given by the mouth, a little ether or chloroform may be added to the dose of the opiate. The opium may be used hypodermically in the form of morphine in the dose of $\frac{1}{6}$ grain (0.01) combined with $\frac{1}{60}$ grain (0.001) of atropine.

In the fevered stage little can be done except to give the patient comfort by cool drinks and cool sponging, or, if the fever becomes excessive, by the use of ice-cold sponging with active friction. These measures have seldom to be used, as the fever is generally too fugitive to need such treatment.

The sweating stage needs no particular treatment unless exhaustion is caused by it, when stimulants may be cautiously used as needed, and large draughts of water at ordinary temperatures swallowed.

Pernicious Malarial Fever.

This is one of the most acute and dangerous infections if it be fully developed, and requires the greatest activity and skill on the part of the physician, who may be called upon to treat a large number of widely varying symptoms, all of a pressing nature, at one and the same time. The chief indication is for the use of quinine in its most soluble forms, in solution and in large doses, which may be given intramuscularly or intravenously. (See Cinchona.)

As a rule, the use of the drug by the mouth is futile because the state of the stomach is such that absorption will not take place in time to be of any service. The intravenous use of the drug is therefore advisable. Given in this manner, doses ranging from 10 to 15 grains (0.6–1.0) may be used at each dose with safety. The dose must be given very slowly, and preferably divided into several smaller doses lest cardiac depression ensue. If the attack be of the hematuric or hemoglobinuric type, quinine is to be used with the greatest caution, and not at all unless the malarial organism can be found in the blood. (See Cinchona.) The patient may be treated by the use of 60-grain (4.0) doses of thiosulphate of sodium every two or three hours until the bowels are moved freely in such cases. Copious draughts of pure water, with or without lemon-juice added, are to be given to flush the kidneys, and if necessary morphine and atropine are to be given hypodermically to control the retching and vomiting.

Remittent Fever.

This is sometimes called bilious fever by reason of the violent bilious vomiting and jaundice which often accompany it. It separates itself from intermittent fever by the fact that the patient's condition, chiefly as regards temperature, does not have normal intervals, but has periods of only temporary improvement, or in other words, the disease remits.

For the proper treatment of this fever, three facts must be borne in mind: (1) It is more dangerous than intermittent fever. (2) The patient, not having periods for complete or partial recovery, rapidly loses strength. The safety of the patient depends upon the use of large doses of quinine to cut short the pyrexial stage, the doses used being from 20 to 30 grains (1.3–2.0) a day or 5 grains (0.3) every four hours, preceded by a good-sized purgative dose of calomel, say 3 or 4 grains (0.2–0.25). If vomiting is too violent to permit of the retention of the quinine, it must be used intravenously, the stomach and intestines being first swept out by the use of divided doses of Seidlitz powder or citrate or sulphate of magnesium. (See Cinchona.) If purgatives are used, they should precede the quinine by sixty minutes, as otherwise the latter drug is swept out in the bowels, where it it is rendered useless by reason of its precipitation by the alkaline juices there present. If pyrexia is excessive, relief must be sought in the use of cool sponging with friction. Cure is much facilitated by absolute rest in bed.

A good treatment of the vomiting is the use of small doses of morphine, or 3- to 5-minim (0.2–0.3) doses of chloroform, in compound tincture of lavender and water. (See Vomiting.)

If the belly is tender, a turpentine stupe should be applied. (See Turpentine.)

If hematuria appears and the malarial parasite is found in the blood, quinine must be used, but it should be remembered that quinine in some cases increases the hematuria. (See Cinchona and Collective Investigation by author in *Therapeutic Gazette*, July, 1892.)

The treatment of convalescence consists in the use of tonics, such as quassia, calumba, gentian, Huxham's tincture, arsenic, and purgatives when needed, with attention to the kidneys, the potassium salts being employed to keep these organs active.

As in the case of all infections it is of the utmost importance that the vital resistance of the patient be kept at the highest point as vital resistance is an important factor in overcoming the parasite. This is particularly the case when syphilis or dysentery is present. The patient cannot get well if the spirochete of syphilis as well as the plasmodium of malaria are both present and antisyphilitic treatment is urgent.

IRITIS.

Iritis, or inflammation of the iris and iridocyclitis, as usually encountered, is caused by syphilis, gonorrhea, tuberculosis, local septic areas, that is, focal infections, and certain diseases of nutrition, for example, gout and diabetes. It may also be traumatic. It is practically never observed in acute rheumatic fever, but often arises in the subjects of so-called chronic rheumatism, polyarthritis and muscular rheumatism, the iritis and the general disease in all probability being due to the same as yet unknown cause. Many types of iritis, iridocyclitis, or uveitis are due to bacterial infections arising from local septic areas, for example, pyorrhea alveolaris, tooth-root abscess, accessory sinus disease, infected tonsils, prostatitis and intestinal putrefaction, the inflammation being called into existence by the microörganisms themselves or their toxic products. Metastatic iritis occurs in pyemia and in a number of infectious diseases, for instance, recurrent fever, variola, influenza, etc. The most marked symptoms of ordinary iritis are severe brow pain; fine ciliary injection; dislocation of the iris and immobility of the pupil, due to the formation of adhesions between the iris and the capsule of the lens, the so-called posterior synechia. The most important local remedy is atropine (4 grains to 1 fluidounce), 1 drop to be used every four hours, according to circumstances. If, for any reason this remedy is not tolerated, duboisine, scopolamine or daturine (2 grains to 1 fluidounce) may be substituted. Great care must be taken not to mistake iritis for conjunctivitis, on the one hand, and glaucoma for iritis, on the other; delayed use of atropine and the employment of astringents on account of the former error, or the instillation of atropine because of the latter, would constitute a serious therapeutic blunder.

Pain may be relieved by leeches to the temple and the use of dry heat externally (cotton batting heated over a radiator will suffice), or hot compresses composed of lint, soaked in water at a temperature of 110° F., frequently changed. In traumatic iritis iced compresses are important. In those forms of iritis which depend upon constitutional disturbance and focal infections, hot compresses usually are more efficacious than iced stupes. In uveitis (sometimes called serous iritis), or that disease in which there is a hypersecretion of the aqueous humor, which becomes turbid, a precipitate of dark spots is deposited on the membrane of Descemet, there must be constant observation of the effect of the atropine, inasmuch as there is frequently a tendency to increase of the intra-ocular tension. Should this occur paracentesis of the cornea may be required. Free sweating, either with the aid of hypodermic injections of pilocarpine or by means of an ordinary electric cabinet, is efficacious, as, indeed, it is in many forms of iritis; of the two methods named diaphoresis, with the aid of an electric cabinet, is the preferable one.

Uveitis depends upon the same causes which are active in the production of ordinary iritis, and its chronic varieties are often due to tuberculosis, and in these circumstances tuberculin therapy, carefully employed, is often advantageous.

In certain forms of iritis, particularly the stubborn and relapsing varieties, subconjunctival injections have been commended, for example, cyanide of mercury (1 to 5000), and similar injections of physiological salt solution which are equally efficacious and preferable because they cause less pain. The writer however doubts whether these injections possess real therapeutic value. The relief of pain in all forms of iritis constitutes an important part of the treatment; hypodermic injection of morphine is perfectly justifiable in emergencies, but must not be repeated too frequently. Hyoscine, $\frac{1}{150}$ to $\frac{1}{100}$ of a grain, at night, is a valuable remedy. Locally, dionin (5 per cent solution) is of distinct value; it stimulates lymphagogue activity and causes somewhat prolonged local analgesia. It may be combined with atropine in the usual strength and reinforced with a 2 per cent solution of phenacaine, commonly called holocaine.

In all forms of iritis it is important to determine the presence of the constitutional disease, or the area of local sepsis (focal infection) which is the source of the disease. Therefore a Wassermann test and a tuberculin test should be instituted. Teeth, tonsils, accessory sinuses, etc., should be examined and pathological conditions corrected and search made for septic foci by roentgen-ray examination of the teeth and sinuses.

If the cause of the iritic inflammation is syphilis, mercury should be pushed to the point of tolerance, but not to that of salivation. Any form of mercury usually employed in secondary syphilis may be used—calomel, blue mass, or protiodide of mercury; very efficacious are inunctions of unguentum hydrargyrum, 1 dram daily preceded by a hot pack, as are also hypodermics of salicylate of mercury. In all types of syphilitic iritis arsphenamine and neoarsphenamine yield admirable results, and under their influence the lesions disappear with surprising promptness. During the intervals between the injections mercury and iodide of potassium may be administered. Mercury is a valuable remedy in non-syphilitic iritis, acting as a powerful alterative. Potassium iodide, either alone or in combination with bichloride of mercury, is frequently employed. In so-called rheumatic iritis, or that form of the disease which appears in the subjects of chronic rheumatism, muscular rheumatism and polyarthritis, salicylate of sodium should be administered in full doses, or aspirin may be employed in its place. Potassium iodide is a proper remedy in gonorrheal iritis, and this form of the disease often responds satisfactorily to profuse diaphoresis. Excellent results follow the use of

Neisser's bacterin. Naturally, such regulation of diet and such remedial agents as are indicated by the various other causes of iritis, for example, gout, diabetes and the like, must receive full consideration, if examination has demonstrated that these factors are etiologically active. Insulin has proved to be valuable in certain forms of iritis associated with diabetes. During the course of iritis the condition of the alimentary canal should receive strict attention, and a course of saline laxatives is followed by excellent results. Colonic lavage is often necessary, and a method of treatment has been elaborated by T. G. Dwyer, which consists in intestinal irrigations, notably of anhydrous sodium carbonate, and implanting the *colon bacillus* and restoring the normal reaction of the intestinal contents has been highly commended. In certain forms of iritis, bacterial in origin, especially if the microörganism can be isolated from an area of local sepsis which is furnishing the infecting agent, autogenous vaccines have achieved admirable results. Foreign protein therapy may be useful. In cases of tuberculous iridocyclitis tuberculin administration is sometimes of service, and recently phototherapy has been advocated. In every case of iritis, or uveitis, the elimination of focal infection is an imperative part of the treatment. The usual foci of infection in this respect do not escape examination, but it should be remembered that chronic prostatitis, non-specific in character, has obtained an etiological significance in this respect which is almost of as great importance as that of chronic tonsillitis. In chronic iritis, and in some forms of relapsing iritis, iridectomy is required to reopen the angle of the anterior chamber which has been closed by inflammatory exudations in order to prevent secondary glaucoma.

KERATITIS.

Keratitis is the name applied to the various types of inflammation of the cornea. If this inflammation is associated with a breach in the continuity of the corneal surface, it is termed *corneal ulcer*, and photophobia, or dread of light; blepharospasm, or spasmodic contraction of the orbicularis muscle; congestion of the bloodvessels; and pain are constant symptoms.

Interstitial Keratitis.

Interstitial keratitis is that form of chronic diffuse inflammation of the cornea characterized by ciliary congestion and a ground-glass appearance of this membrane, most common between the ages of five and fifteen years, and in the majority of cases the result of inherited syphilis. In from 2 to 10 per cent of the cases acquired syphilis is the etiological factor. No local measure is sufficient, antisyphilitic treatment being of paramount importance. Arsphenamine and neoarsphenamine are valuable in syphilitic cases; also inunctions of unguentum hydrargyrum. During the height of the ciliary congestion warm antiseptic lotions and atropine are indicated, the latter especially to prevent the tendency to iritis. Dionin is of value. Similar forms of keratitis are caused by rhachitis, tuberculosis, myxedema and depressed nutrition. In addition to the local measures already described, appropriate constitutional remedies are required, particularly iron, arsenic, cod-liver oil and the iodides. Suitable dietetic and general hygienic measures are important, and in tuberculous cases injections of tuberculin are efficacious. Patients with interstitial keratitis should be subjected to Wassermann and tuberculin tests.

Various other types of keratitis are described as the result of constitutional disturbances, such as gout (Hutchinson), malaria (Kipp, Ellett), or any condition of the system associated with great exhaustion, such as irregularities in the menstrual function, certain forms of pulmonary disorders (true herpes of the cornea, Horner). The local management of these cases does not differ from that which has been described. (See also Ulcerative Keratitis.) The coexisting constitutional disturbances are combatted with suitable remedies. Parenchymatous keratitis apparently is due in some cases to defective intestinal function and autointoxication. Some forms are the result of focal sepsis in the buccal mucous membrane, the tonsils, paranasal sinuses and the prostate and posterior urethra and some types result from traumatism.

Phlyctenular Keratitis.

Phlyctenular keratitis appears in the form of small, blister-like bodies, sometimes single, sometimes multiple, frequently situated directly at the corneo-scleral margin, which become yellow, break down, and leave an open ulcer (phlyctenular ulcer), to which runs a leash of injected bloodvessels. The disease is common in children, often follows in the wake of the exanthemata, and is so frequently associated with a so-called strumous diathesis that it was formerly called strumous ophthalmia. The clinical association between this disease and eczema of the face and scalp is an intimate one. In the majority of cases there is coexisting nasopharyngeal disease, especially adenoid vegetations, which are responsible for the frequent relapses of the disorder, even if they do not cause it. Adenoids and infected tonsils should be removed, also infected teeth. Congestion may be relieved by frequent irrigation with a warm boric-acid solution. Pain and irritation call for the use of atropine drops (4 grains to the ounce [0.25–30.0]), which should be continued until the ulcer is covered with regenerated epithelium, when the process of cicatrization may be hastened by the insertion daily into the conjunctival sac of a small quantity of yellow oxide of mercury salve, or dusting it with finely powdered calomel, providing the patient is not taking at the same time any form of iodine. During the whole treatment the eyes should be protected by dark glasses and the subject permitted to go out into the open air. All local treatment will prove unsatisfactory unless associated with strict hygiene, carefully regulated diet, and constitutional measures—tonics and alteratives— and treatment of the nasopharyngeal lesions.

The evidence is daily increasing that phlyctenular keratitis is closely connected with tuberculosis and probably caused by it. Hence its subjects, especially in dispensary service, should be treated like other cases of tuberculosis, viz., after the patient is instructed as to general living, proper food, etc., he is visited by one of the workers in the social service of the hospital, and is shown how to live and helped to carry out all directions; carefully regulated doses of tuberculin are advocated by many surgeons.

If the photophobia becomes distressing in spite of the other treatment, it has been suggested that this may be relieved by the use of cocaine, a practice that by no means commends itself in corneal ulceration, in spite of the temporary relief from local anesthesia. Phenacaine (holocaine hydrochloride) (2 per cent) may be employed.

Ulcerative Keratitis.

Ulcerative keratitis, or ulcers of the cornea, may be primary in origin—that is, the disease begins in the cornea—or it may be caused by phlyctenular disease, injury, abscess, depressed nutrition, etc.; or may be secondary, and result as the sequel of severe inflammations of the conjunctiva: for example, purulent, diphtheritic, or granular conjunctivitis. There are numerous varieties of corneal ulcers, but three groups only will be mentioned: simple ulcers, which form a small, superficial gray lesion, and are not accompanied by much vascularity or dread of light; purulent or deep ulcers, in which the open lesion is of yellowish color and is surrounded by hazy cornea; and infecting or sloughing ulcers (purulent keratitis), in which the ulcer assumes a serpiginous or creeping form, and there is usually a deposit of pus at the bottom of the anterior chamber (hypopyon keratitis). Typical serpiginous ulcer of the cornea with hypopyon is frequently caused by the Fränkel-Weichselbaum capsulated diplococcus; ulcers not typically serpiginous may originate from a staphylococcus, streptococcus or mixed infection; and a small percentage of sloughing keratitis is due to a schizomycetal infection—the aspergillus fumigatus. Other active organisms are Bacillus coli, Bacillus pyocyaneus and diplobacilli, especially Morax-Axenfeld diplobacilli. The various microörganisms come from the conjunctiva, the ciliary borders, the nares, and the lacrimal passage, and infect some slight abrasion on the corneal epithelium and thus start a dangerous form of suppurative keratitis.

An abscess of the cornea may also occur as the result of an inoculation of the infected area with pathogenic microörganisms, typical forms sometimes appearing during scarlet fever, measles, typhoid and typhus fevers, and especially during the convalescent stage of smallpox. Infected ulcers may be caused by microörganisms from areas of local sepsis in the gums, as pyorrhea alveolaris, or in the tonsils or paranasal sinuses. Simple corneal ulcers are treated in precisely the same manner as phlyctenular ulcers. The treatment of severe ulcerations of the cornea, no matter what its etiology, may be summarized as follows: (1) Search should be made for the cause of the ulcer, including careful examination for the presence of a foreign body, a misplaced cilium, conjunctival inflammation, lacrimo-nasal disease, affections of the rhinopharynx, oral sepsis and constitutional disorders of all types. The active microörganism should be determined by appropriate bacteriological examination. (2) Conjunctival discharge should be removed by frequent irrigations with mercuric chloride (1 to 8000), or a saturated solution of boric acid. Protargol (10 per cent) and argyrol (25 per cent) are also used. Care must be taken lest they stain the affected corneal tissue. Mercurochrome (1 per cent) and mercurophen (1 to 20,000) are also valuable. (3) Sterile atropine drops (4 grains to the ounce [0.25–30.0]) should be instilled with sufficient frequency to maintain mydriasis if there is any tendency to iritis, and dionin (5 per cent) is of great service. In the opinion of some surgeons eserine ($\frac{1}{4}$ to $\frac{1}{2}$ grain to the fluidounce) is a useful drug in the treatment of peripheral ulcers with a tendency to perforate the cornea, provided there is no iritis. Occasionally the tension rises; if so, myotics are indicated or paracentesis of the cornea. (4) The eyes should be protected with smoked glasses; but in severe cases and in the absence of purulent conjunctival discharge a dry antiseptic dressing, held in place by a light, but firmly applied bandage, promotes healing and prevents perforation. It may be worn until the floor of the ulcer is covered with epithelium, and removed whenever the applications are required. A little iodoform may be dusted upon the surface of the ulcer before the bandage is applied, or the ulcer may be recovered with an iodoform wafer. If the Morax-Axenfeld bacilli are present the ulcer should be touched with a 1 per cent solution of zinc sulphate. (5) If the ulcer shows a tendency to spread rapidly it should be curetted and immediately afterward gently touched with a probe which has been dipped in pure phenol, or with a wisp of cotton which has been dipped in a solution of nitrate of silver (10 grains to the ounce), tincture of iodine, or trichloracetic acid (1–20). Of these remedies nitrate of silver and tincture of iodine may be used in ulcers of the non-infective type; but in ulcers of the infective variety pure phenol or trichloracetic acid should be employed. (6) If the ulcer continues to spread the actual cautery may be used the glowing point of the cautery being applied to every portion of the ulcer, the area of which is outlined by means of fluorescine (2.5 per cent solution), which will color green any portion of the cornea deprived of its epithelium, and therefore furnish a reliable guide as to the extent of the destructive process. Before these severe applications are made the cornea should be rendered insensitive by a few drops of a phenacaine solution, and the ulcer itself painted with a cotton wisp dipped in phenacaine. Indeed, there is much evidence to show that the application alone of this drug has a distinctly curative influence on corneal ulcers, in this respect differing very distinctly from cocaine, which retards the cicatrizing process. Subconjunctival injections of cyanide of mercury (1 to 5000) or of physiological salt solution at times yield satisfactory results. If an abscess forms in the cornea the pus should be evacuated by an incision; and hypopyon, or pus in the anterior chamber, may be drained by an operation after the manner devised by Guthrie—that is, by division of the corneal layers—or, by a simple paracentesis of the cornea. Of great value in the treatment of infected corneal ulcer is the method often called "pasteurization," whereby the glowing blade of an electrocautery is passed over the ulcerated area and close to it, but does not actually touch the ulcer, or, even better, Shahan's *thermophore* may be used, whereby the exact degree of the heat (145° to 160° F.) can be ascertained.

For the relief of infected ulcer of the cornea due to the pneumococcus, Roemer's antipneumococcus serum has been employed subcutaneously in a dose of 3 to 5 cc. Good results have been reported, but its action does not seem to be sufficiently certain to allow it to replace other methods. On the other hand, a bacterin prepared from the microörganism which is responsible for the corneal infection, by which an active immunization is created, has in a number of reported instances been of service, but even such a bacterin must not be used to the exclusion of the other remedies which have been described. In place of antipneumococcus serum, antidiphtheritic serum should be employed in the treatment of severe corneal ulceration. It acts as a foreign protein and produces admirable results. Foreign protein therapy may be employed by injections, 3 to 5 cc., of *whole boiled milk* into the gluteal or abdominal muscles or by the use of aolan (5 cc. injected for six days in succession) if no unfavorable reactions occur. In *pneumococcus* ulcers of the cornea the direct application of *ethylhydrocupreine* (optochin) in 5 per cent solution to the ulcerated area is advantageous. Of the various methods of treating infected ulcers of the cornea, thermotherapy and the injection of foreign proteins are especially valuable in their effects. Recently phototherapy has been much employed.

Sequelæ of Corneal Ulceration.

After healing of a corneal ulcer the cicatrix consists of a more or less dense white spot in the cornea (macula). If these scars are thick and white (leukomas), they are irremediable by local medication and require surgical interference for relief. If, however, they are diffuse (nebulas), much good will follow systematic massage of the cornea, aided by the introduction of a small particle of yellow oxide of mercury salve. The massage is performed as follows: A piece of the salve the size of a split pea is introduced beneath the upper lid; upon the closed lid a finger is placed, and regular motions made through the lid over the surface of the cornea—namely, vertical, lateral and radial motions, the *seance* being completed by circular movements. The whole procedure should last from one to three minutes. Alleman claimed excellent results in dissipating corneal opacities by the use of electricity by connecting a suitably prepared electrode with a battery, the cathode being placed directly on the previously anesthetized cornea and the anode on the cheek. Subconjunctival injections of physiological salt solution, placed near the corneal margin, have some power in causing absorption of corneal nebula. The internal administration of thiosinamin has been recommended; the author has never observed encouraging results from the use of this remedy or of fibrolysin (15 per cent solution given by injection). Dionin is of service in corneal infiltration of recent origin. It may be used in solution (5 to 8 per cent) or in the form of a salve, and may be combined with yellow oxide of mercury. The protrusion of a cicatrix following the perforation of a severe corneal ulcer, due to its failure to resist the effect of intra-ocular pressure, constitutes a *staphyloma*. Pressure bandages, myotics and, in suitable cases, iridectomy may be of avail in checking the development of staphyloma, but often enucleation is required.

LACRIMAL ABSCESS.

Lacrimal abscess results from suppuration in a chronically distended lacrimal sac owing to the presence of obstruction in the nasal duct, and exists as a swelling under the skin at the inner canthus, pressure upon the surface causing an escape of pus through the canaliculi. The treatment is practically confined to surgical interference—that is, division of the canaliculi and washing out the distended sac with antiseptic fluids, and removing the obstruction in the nasal duct by the use of probes as soon as the inflammatory symptoms have subsided; or, if the skin over the seat of the abscess is thinned and rupture is threatened, by free incision downward and outward. In purulent discharge from the lacrimo-nasal duct solutions of formaldehyde (1 to 6000), nitrate of silver (1 to 500), or argyrol (2 to 5 to 100), injected through the passage, have been recommended to modify the unhealthy secretion but great care must be taken lest the silver salts penetrate through a false passage into the surrounding connective tissue and form an indelible stain. Indeed the author is satisfied that none of the silver salts should ever be used as injections for the reason stated. Much comfort will ensue from the use of hot compresses over the inflamed area. Excision of the lacrimal sac is the usual surgical procedure for chronic dacryocystitis, although many surgeons prefer one or other of the various procedures for draining a chronic dacryocystitis into the nose.

LARYNGITIS (ACUTE).

The treatment of acute laryngitis is identical in many respects with that directed against acute inflammatory processes elsewhere. It may be divided into local, external, and internal methods. The condition of the larynx when acutely inflamed is that of intense hyperemia and irritation, and the object of the physician must be to allay this irritability. This is best accomplished by the use of compound tincture of benzoin, which is placed in boiling-hot water (1 ounce to the pint [30.0 to 480 cc.]), and the steam inhaled as it rises from a pitcher or as it passes out of the nozzle of a deep coffee-pot. (See Inhalations, Part III.) This inhalation should be resorted to six or eight times a day, but the patient must not go out of doors or into a cold room, as the steam relaxes the parts involved and renders them more susceptible to cold. Sometimes advantage is gained by adding to this inhalation 1 grain (0.06) of menthol. If the patient is unable to remain in an equable temperature, then the steam inhaler should be supplanted by a nebulizer, in which should be placed the following mixture:

℞—Mentholis	gr. iij (0.2)
Alboleni	f℥j (30.0).—M.

S.—Use as a vapor.

The patient is directed to inhale this vapor gently, which because of its lightness readily passes deeply into the air-passages, and has the effects of soothing rather than irritating them as does the spray from an atomizer.

Rarely in the very acute stages of laryngitis should a water spray be employed to wash the laryngeal mucous membrane, as it is apt to increase the irritation. If any aqueous spray is used, as may be necessary when the irritation has resulted from the inhalation of dust, it may be made up as follows:

℞—Sodii chloridi	gr. xv (1.0)
Acidi borici	gr. x (0.6)
Sodii boratis	gr. x (0.6)
Aquæ rosæ	f℥iij (90.0).—M.

S.—Use as a spray.

The external treatment, if the inflammation is exceedingly severe and the patient can be confined to bed, consists in the application of a mustard-plaster over the larynx, or instead a cold compress should be applied and kept in place with a long stocking tied around the neck. This soon becomes a warm compress by the heat of the body and may be kept in place all night. The cold followed by heat produces excellent results. A mustard foot-bath and a warm drink on going to bed are useful.

The internal treatment should consist in opening the bowels with calomel and a saline purgative if constipation is present, and in the administration of full doses of aconite and bromide of sodium or strontium, as follows:

℞—Tincturæ aconiti	♏xl vel lxxx (2.6–5.3)
Sodii bromidi	ʒij (8.0)
Syrupi lactucarii	f℥j (30.0)
Aquæ destillatæ q. s. ad	f℥iij (90.0).—M.

S.—Dessertspoonful (8.0) every hour until six or eight doses have been taken.

This prescription may in many cases be continued until convalescence, as it checks cough, soothes the inflamed area, and allays arterial excitement. Often it is best to omit the aconite after the first few doses. In other cases good results follow the use of 2 or 3 minims (0.12–0.2) of dilute nitric acid in water every half-hour or hour for six doses. This is useful in the early stages only. By the second day the patient should be directed to make a heavy application of tincture of iodine over the trachea and episternal notch, as high as is possible without the stain showing above the collar. In children and in some adults this is well substituted by oil of amber and sweet oil in the proportion of 1 to 3 parts rubbed on the skin or one of the well known mentholated ointments.

For the laryngeal stiffness following the inflammation preparations of nux vomica are very useful given internally, and tonics to the general system are needed. In many cases the prescription calling for ammonium chloride in the article on Bronchitis is useful.

It is to be recalled that hoarseness may not be due to laryngitis, but to tuberculosis or to a papilloma or again to an aneurysm of the aorta; aphonia in a young woman may be due to hysteria.

LEUCORRHEA.

This is a condition—vulgarly known as the "whites"—consisting in a hypersecretion from those glands which pour out their contents into the vagina or the cervical canal of the uterus. It is a state dependent upon many causes for its existence, the chief of which is laceration of the cervix uteri in child-bearing women. Leucorrhea very rarely comes from any disease of the endometrium. Cauterization of the cervix gives results but curettage of the uterus except for diagnostic purposes is very rarely efficacious. Repeated infection of the cervix may arise from infected Skene's tubules or Bartholin's ducts in the case of chronic gonorrhea. The best treatment for leucorrhea of the cervical region is cauterization of the cervical mucosa. The character of the discharge varies with almost every case. In some instances it is thick and tenacious, and in others so liquid as to trickle down the limbs and soil the clothing. When the secretion is very thick and tenacious it generally arises from the cervical canal, while that from disorder of the vaginal wall alone, independent of other morbid conditions, may be either thick or thin.

The treatment of these forms of leucorrhea may be divided into two parts—one, that directed to the remedying of the morbid process through the use of drugs by the mouth; the other, by their employment locally. In obstinate cases the repair of a lacerated cervix or the curettement of the uterus is necessary.

It is needless to state that in that form dependent upon excessive lactation or other exhausting manner of life tonics of an active character are needed. As a general rule, anemia will be present, and the following pill will be found of service:

℞—Arseni trioxidi	gr. ¼ (0.015)
Ferri reducti	gr. v (0.3)
Quininæ sulphatis	gr. xx (1.3).—M.

Fiant pilulæ, No. xx.
S.—One pill three times a day, after meals, for an adult.[1]

Or,

℞—Tincturæ cinchonæ compositæ	f℥ij (60.0)
Tincturæ gentianæ compositæ q. s. ad	f℥iv (120.0).—M.

S.—Dessertspoonful (8.0) three times a day, after meals.

The following pill may also be employed:

℞—Hydrargyri chloridi corrosivi	gr. ½ (0.03)

Fiant pilulæ, No. xx.
S.—One pill three times a day after meals, or a tablet triturate may be used instead of a pill.

When any preparation of iron is used care must be taken that the bowels are kept active and that the stomach is not disordered. Associated with the use of these internal remedies should be a moderate amount of exercise and the avoidance of late hours and rich foods.

The local applications which are of value in these states consist in counterirritation and vaginal injections or painting with proper fluids the mucous membrane of the parts from which the discharge comes. In the leucorrhea dependent upon irritation of the ovaries associated with catarrh of the Fallopian tubes the use of small blisters formed by the employment of cantharidal collodion or a cantharidal plaster over the groin on either side is often accompanied by good results. At the same time the vaginal surfaces surrounding the cervix uteri may be painted with a mixture of iodine, phenol, and chloral, such as was used by Goodell, as follows:

℞—Iodi resublimata	ʒiv (16.0)
Phenolis,	
Chlorali hydrati āā	℥j (30.0)

Rub the iodine and chloral in a glass mortar into a powder and add the phenol.
S.—Formula. To be used by the physician only.

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[1] In this prescription the small amount of iron given will probably be noted but this is done advisedly, as iron does as much good to the blood in small as in large amounts under most circumstances. (See Iron.)

The remaining treatment of watery leucorrhea consists in the use of astringent injections. A cheap astringent injection is made by adding 1 ounce (30.0) of powdered white-oak bark to each pint (480 cc.) of hot water, or tannic acid and glycerin in the proportion of 1 ounce to 2 quarts (30.0 to 1920) of warm water. Ringer recommended the following:

℞—Sodii bicarbonatis	ʒj (4.0)
Tincturæ belladonnæ foliorum	fʒij (8.0)
Aquæ	Oj (480 cc).—M.

S.—Use as a vaginal wash.

Where the discharge is fetid a solution of permanganate of potassium should be used as an injection in the strength of ½ dram to 1 pint (2.0 to 480 cc.) of water.

In purulent vaginitis, specific or otherwise, the following injection is serviceable:

℞—Creolini	fʒss vel fʒij (2.0–8.0)
Fluidextracti hydrastis	fʒiiss (10.0)
Aquæ	f℥viij (240.0).—M.

S.—Add 2 tablespoonfuls to a pint (30.0:480 cc) of hot water, shake thoroughly and use as an injection.

A very useful astringent injection is:

℞—Zinci sulphatis	ʒj (4.0)
Alumini sulphatis	ʒj (4.0)
Glycerini	f℥vj (180.0).—M.

S.—A tablespoonful (16.0) to each quart (1 liter) of water.

The injected fluid should always be as hot as the patient can bear, as tepid injections are harmful.

Sometimes a tampon thoroughly saturated with a powder of iodoform and tannic acid, equal parts, and packed around a discharging uterine cervix is of service.

When using vaginal injections it is important to remember that they should be in large quantities. Nothing is more antagonistic to true asepsis than the manner in which these applications are often made. Often a pint of the solution is placed in a basin over which the woman squats, and by means of a syringe forces the liquid into the vagina as fast as it run out, thereby filling the syringe joints with the dissolved secretions, and returning to the vagina as soon as they flow away the impurities which have left it. The only proper way to give such an injection is to use a fountain syringe or to have the solution in one basin, to the extent of 1 gallon (4 liters), while the patient squats over a second basin, into which the impure liquid may run.

LID ABSCESSES.

Lid abscesses are seen more frequently in children than adults, as the result of injury, the sequel of acute illness (epidemic influenza, pulmonary catarrhs, fever, etc.), or from local infection; under the pulmonary catarrhs, the exanthemata, fever, etc.), or from local infection; under the latter circumstance they may assume a gangrenous type. The treatment is that for any form of abscess—hot compresses, early incisions, antiseptic solutions, and tonics.

LUMBAGO.

This is a form of myalgia or muscular rheumatism of the muscles of the loins and small of the back, and is frequently the result of lifting heavy weights, or it is due to other strains. In many cases acupuncture is very useful, particularly if the trouble is bilateral. Sometimes after the employment of this measure the patient can straighten the back at once and retain that position. Prompt relief often follows the intramuscular injection of 5 cc. of a 1 per cent solution of quinine and urea hydrochloride into the painful area. In other instances antipyrine or acetanilide, in 5- to 10-grain (0.3-0.6) doses of the former and 4- to 8-grain (0.25–0.5) doses of the latter are of service, and iodide of potassium and salicylic acid are not to be forgotten if the condition of the patient does not rapidly improve. Aspirin, phenacetin and phenyl salicylate (salol) are also useful, combined or alone. A large hot poultice applied to the back is often efficacious in obstinate cases. Sometimes the use of a hot foot-bath and a Dover's powder on going to bed will produce a cure, and ironing the back with an ordinary hot laundry iron at a proper heat, a piece of newspaper or cloth being placed over the skin under the iron, is very efficient. Counterirritation in the shape of a blister, a mustard-plaster, or capsicum draft will often give relief. No diagnosis of lumbago should be made until sacro-iliac or lumbo-sacral strain has been excluded. Strapping often relieves sacro-iliac and lumbo-sacral pain. (See Sciatica.)

MALARIAL FEVER.

(See Intermittent and Remittent Fevers and Pernicious Malarial Fever.)

MANIA (ACUTE).

Space is wanting to consider the thorough and complete treatment of mania as it comes to the neurologist. All that can be mentioned here are temporary measures suitable for cases which are brief in their course.

For the rapid quieting of the patient hyoscine hydrobromide may be used hypodermically in the dose of $\frac{1}{50}$ grain (0.0012) with $\frac{1}{4}$ grain of morphine. In other instances, if the kidneys and heart are healthy, full doses of chloral may be used; and if an active preparation of cannabis can be had, at least $\frac{1}{2}$ grain (0.03) of the solid extract or

$\frac{1}{2}$ to 1 dram (2.0–4.0) of the tincture should be employed. Cannabis will be found much more serviceable if 60 grains (4.0) of one of the bromides be combined with it.

When a patient suffering from mania is so violent that nothing can be done with him, he should be held, and an emetic dose of $\frac{1}{12}$ grain (0.005) of apomorphine be given hypodermically to produce vomiting and so relax the muscular system; or he may be tied or anesthetized sufficiently to enable the physician to administer proper remedies. Sometimes full doses of morphine are needful, or a cold douche to the head while the body is in a tub of hot water is of service. In others a hot cabinet bath or Russian bath is a valuable sedative, and, if possible, should be used in preference to drugs. (See Heat.) In hospitals the continuous hot tub bath gives excellent results.

MEASLES.

In the treatment of measles, it is essential from the beginning to the end of the attack, the patient should have absolute rest in bed, be placed on a simple, easily assimilated diet and be kept in a well ventilated room devoid of draughts. Fever and restlessness may be modified by tepid sponging. If the rash is not well developed and the child is toxic a warm pack may be employed for a few minutes and a few drops of sweet spirit of nitre given in cool water every hour or two. Danger in any case arises from bronchitis, bronchopneumonia or middle ear infection.

It is now established beyond question that the blood serum of patients recently recovered from an attack can be used as a prophylactic when an epidemic is present and as a cure, or at least a modifying agent, when the attack has developed. Some clinicians doubt it has curative properties. At present all the serum used is that derived from convalescent patients. Serum obtained from animals has not proved of any value.

The dose of convalescent serum used for protection is 5 cc. given hypodermically usually in the abdominal area. If the patient is already suffering from the disease the dose is 3 to 5 cc., repeated if after twelve or twenty-four hours marked improvement does not take place.

The method of obtaining the serum from a recently convalescent patient, if possible, preferably on the sixth or seventh day after defervescence, is as follows: After preparing the bend of the elbow, as is done when an intravenous injection is to be given, a needle of large caliber, to prevent early clotting in its lumen, is introduced and the blood flows directly or by the aid of a large syringe. The quantity taken depends upon the purpose of the physician. If only one child is to be treated only 10 cc. of blood need be taken, put in a wide-mouth sterile bottle and placed on ice until separation of the clot has occurred, when the serum is withdrawn and injected. If many persons are to be treated, and the donor is healthy and large enough, as much as 250 cc. may be taken and placed in a bottle containing 16 cc. of sterile water to which has been added 0.25 chinosol as a preservative and 0.5 sodium citrate. Such a serum can be kept for a number of days and carried from one place to another if properly protected. Children over three years of age usually stand measles well and, therefore, the use of serum is not always needful.

As is the case always when human serum is employed the blood of the donor should be first subjected to tests for syphilis and no prospective donor should be accepted if possibly tuberculous.

In connection with the use of convalescent serum for prophylaxis the following is of interest. It is to be recalled that the importance of measles as an acute infectious fever varies with conditions and circumstances. In private practice with good nursing a previously healthy child will usually recover without the use of serum. When no convalescent child serum can be obtained it is to be remembered that the serum of a parent who has suffered from measles at some time may be resorted to. On the other hand, if the child has a very low vitality the disease may run a severe course if not modified. Again in institutions where children are living who have been started in life with a low vitality, and particularly if they are young infants, the serum is very useful if used as a prophylactic or a cure. There are two plans of employing convalescent serum as a prophylactic. In one the design is to induce after exposure an absolute immunity at least for a short time. For this purpose, according to Karelitz and Levin a child of three years who has been exposed from one to four days should receive 5 cc. of convalescent child serum, or 25 cc. of adult serum if the donor has had measles early in life. Some clinicians assert that the best results follow the use of the serum if given about the fifth or sixth day after exposure. If exposed from five to seven days 10 cc. of child serum or 40 cc. of even 75 cc. or adult serum. Even larger amounts are used for older children. It is uncertain how long immunity is assured at the time of writing this article. It would appear to be relatively brief. The other plan is to use doses one-half the above sizes with the view that they will not induce complete protection but so modify the disease that it will not be severe and that this modified form of measles having been allowed to develop the child will not only escape a severe attack but by reason of having had measles will obtain the persistent immunity which usually lasts for life when the disease runs its ordinary course to recovery. These smaller doses may in a certain proportion of patients be effective in inducing complete prophylaxis. Such modified measles has an unusually long incubation period as a rule.

As measles serum is human serum, there is little or no danger of anaphylaxis, unless it has been used at some previous time.

MELANCHOLIA.

This is not the place for the discussion of melancholia of so severe a form as to amount to insanity, since the treatment of this latter state is very various and largely depends upon the skill of alienists.

There is one form of melancholia, however, which may often be quickly relieved by a simple measure. It is that dependent upon the condition of the system in which oxaluria is present. Whenever an individual complains of melancholia the urine should be examined, and if an excess of oxalate crystals are found, the strong, freshly made nitrohydrochloric acid should be given in the dose of 5 minims (0.3) after each meal in ½ tumblerful or more of water. In order to guard against errors in diagnosis it is well to remember that pears, tomatoes, rhubarb, and cabbage all cause oxalates to appear in the urine for a short period after their ingestion.

MENINGITIS (ACUTE).

In a large proportion of cases the development of meningitis is secondary to some other state of disease, as, for example, otitis media or croupous pneumonia. Under these conditions the treatment must be governed by the exciting cause.

When meningitis is due to tuberculosis we can do nothing save to give relief from pain, if it is present, by sedatives and lumbar puncture. When it is due to an infection of the meninges by the pneumococcus or typhoid bacillus this is also true, although antipneumococcus serum may be used intraspinally. (See Ethylhydrocuprein, Part II.) Recovery from pneumococcus meningitis is almost unknown.

If it is caused by the Diplococcus intracellularis of Weichselbaum, that is, if it be true cerebrospinal meningitis, the only remedy of any real value is the antimeningitis serum, which is to be injected into the spinal canal after an equal quantity of cerebrospinal fluid has been withdrawn. (See Antitoxin.) It should also be given intravenously. It is to be recalled that this serum acts as a bacteriolytic agent rather than as an antitoxin. In the way of palliative measures the following may be resorted to.

During the first acute stage an ice-bag should be applied to the head both for its local influence and its antipyretic effect, and leeches may be put at the nape of the neck with advantage. As the disease advances and the nervous disorders of the affection become marked, sedatives are required to ally the twitchings, muscular spasms, or convulsions, and for this purpose no drugs excel chloral and the bromides. The doses to be used vary with the violence of the symptoms, but it may be stated that the chloral should rarely, if ever, be used in doses above 20 grains (1.3), and the bromides given in the dose of from 20 to 40 grains (1.3–2.6). If coma comes on, cistern puncture with drainage and injection of serum is advisable.

Quinine has been recommended in meningitis, but it is absolutely contraindicated, as it predisposes to meningeal congestion.

The treatment of the convalescent stage of meningitis must be necessarily supportive. Alcohol should be given with the food if weakness is present, and a very simple or milk diet insisted upon.

If symptoms of cerebral pressure are marked, lumbar or cistern puncture should be performed, the technique of which is described under Lumbar Puncture. (See Lumbar Puncture, Part III.) In many cases the relief is only temporary, but in a few it is permanent.

MIGRAINE.

Migraine is a form of head pain usually limited to one side of the head—hemicrania. It is often characterized by the presence of severe boring pain in the eyeball or over the brow on one side. Associated with or preceding this pain there may be some dimness of vision or even a true transient amblyopia. The exact pathology is not clear, and so our treatment of it is perforce largely empirical. As soon as the first warning symptom develops a bottle of citrate of magnesium should be taken, even if constipation is not present. Before the introduction of the coal-tar products as pain-relievers (see Headache), the best treatment of the attack of pain consisted in ordering the patient to bed and giving him 15 to 30 drops (1.0–2.0) of tincture of gelsemium, with $\frac{1}{4}$ to $\frac{1}{2}$ grain (0.015–0.03) of extract of cannabis every two hours. If the heart is feeble, the fact that gelsemium is a cardiac depressant must not be forgotten. So far as the other measures for relief of the individual attack of pain are concerned, reference should be made to the article on Neuralgia. For the cure of the condition which results in the attack, the endeavor should be to keep the liver active, since the failure of this organ to destroy the poisons which cause an attack, and its failure to prevent fermentation in the bowel by the proper secretion of bile, is supposed to be the chief cause of the disorder. The use of sodium phosphate, taken in hot water every morning and on first arising, does good in many cases, particularly if the patient also takes some one of the salicylates several times a day. In some cases 2 to 4 drams of Epsom salts taken every night on retiring prevent the attacks probably by emptying the stomach and duodenum during the night. When the attacks are frequent they may be treated by daily duodenal lavage. The constant ingestion of the Bacillus acidophilus is often very valuable.

An occasional free catharsis with blue mass is advisable in many of these cases. Usually 5 to 10 grains (0.3–0.6) once a week and followed by a saline is sufficient. It is essential that all causes of systemic and nervous worry be removed in these cases, and the use of chocolate and rich foods or drinks be forbidden. Excessive sexual indulgence is often a cause of the attacks, and it must be interdicted. (See also articles on Headache and Neuralgia.)

Some cases of migraine due to intranasal pressure are relieved by turbinectomy or straightening the nasal septum. A low-grade inflammation in one of the bony sinuses is not to be forgotten. So too pain in the sphenopalatine ganglion is to be borne in mind as a cause and treated by applying a cocaine or procaine solution to that region. Foods with high purin content are to be avoided.

MUSCÆ VOLITANTES.

Muscæ volitantes is the name applied to the dark specks which patients frequently see floating across their fields of vision, especially if the eyes are directed toward a bright sky or a white page. Frequently they indicate no disease of the vitreous humor, and the ophthalmoscope fails to detect abnormal changes. They are attributed to torpidity of the liver by the laity. Muscæ volitantes may indicate eye-strain, and if the refraction is abnormal this should be corrected; a mild course of alteratives is often a useful adjuvant.

MYALGIA.

Soreness of the muscles either on pressure or on movement may be dependent upon a number of causes, such as strains, bruises, toxemia, or inflammation due to cold. Here, as in many other states, the treatment should be divided into the external and the internal methods. Of the internal remedies, the best are the salicylates or the iodide of potassium if rheumatism be the cause of the trouble. On the other hand, if a bruise or cold be the cause, the chloride of ammonium will be of service in 10- or 20-grain (0.6–1.3) doses given in a solution with fluidextract of liquorice. (For prescription see Bronchitis.) Other remedies which may be tried with a good chance of success are full doses of acetylsalicylic acid with or without acetanilid.

The local medications are numerous, but only a few can be considered as worthy of routine employment. The chief one is iodine, in the form of the pure ointment or the ointment diluted one-half with lard if the skin is easily irritated. Another method is to employ a liniment, well rubbed into the skin, made up as follows:

℞—Tincturæ belladonnæ foliorum		f ʒiss (6.0)
Tincturæ aconiti		f ʒvi (24.0)
Tincturæ opii		f ʒij (8.0)
Linimenti saponis	q. s. ad	f ℥vj (180.0).—M.

S.—Poison. To be used externally and only as a liniment.

Sometimes chloroform liniment is singularly successful, and poultices applied as hot as can be borne and covered by oiled silk and cotton to retain the heat are often of great value. Massage or good rubbing is also a *sine qua non* for the successful treatment of this state. The use of high heat from electric lamps with carbon filaments or the infra-red rays from a zoalite lamp are very useful.

NASAL CATARRH (ATROPHIC).

In atrophic nasal catarrh the nostrils are roomy and the mucous membrane red and shiny. The formation of connective tissue has to a great degree obliterated the delicate mucous glands, and the mucus forms inspissated crusts, which adhere to the mucous membrane of the septum and turbinated bodies. Areas of ulcerated or abraded membrane are disclosed upon removal of these adherent crusts.

The turbinated bodies are gradually absorbed and the secreting surface thereby much reduced. Sometimes the wasting is so great that the posterior wall of the pharynx is clearly visible through the anterior nares. The inspissated secretion may form a cast of the nostril, and as fresh layers form underneath, the oldest part is raised until the whole interior of the nostril becomes a mass of decomposition, giving rise to an overpowering stench. This form of catarrh causes loss of the sense of smell, and the odor is not recognized by the patient himself. Ulceration or caries of the bony structure produces an odor even worse than the so-called *ozena*. The *pharynx* suffers from the general wasting, and presents a dry, varnished appearance called *pharyngitis sicca*, which is rather a symptom of nasal atrophy than a separate disease of the pharynx.

The indications are the removal of all accumulations in the nose and nasopharynx and the healing of abraded or ulcerated surfaces. The early removal of dead bone is imperative, and what secreting surface remains must be stimulated as far as possible, to compensate, in a measure, for the glands that are hopelessly destroyed. In other words, efforts are directed toward producing a *compensatory hypertrophy* of the glandular tissue that remains. Therefore the use of antisepsis, alteratives and local stimulation are combined.

The nose should be thoroughly cleansed with an alkaline wash—Dobell's solution—warmed to increase its solvent power. To relieve the *odor*, we may increase the amount of phenol or substitute for it eucalyptol and thymol in the wash. Euthymol contains both of these and may be added to the wash. Its own pungent odor masks somewhat the offensive odor. Permanganate of potassium may be used in weak solutions, but it is painful except when sensation is entirely lost. Peroxide of hydrogen is valuable, used in an atomizer in the strength of 1 part to 10 or 1 to 20. After this has softened the crusts they should be dislodged by the further use of a warm alkaline spray, and after the cleansing is complete ichthyol, pure or diluted one-half with water or albolene, is applied by means of an applicator. Often a much weaker solution of ichthyol will do equally well. The patient may be given a salve of:

℞—Ichthyolis	gr. xl (2.6)
Mentholis	gr. v (0.3)
Petrolati albi	℥j (30.0).—M.

A piece of this is to be inserted into the nostril, after using a douche, each night.

The solutions are best applied by means of an atomizer, or post-nasal syringe in the hands of the physician, or by snuffing from the hand or cup.

The odor, if due to decomposition, is much decreased as soon as the passages are clear. The discharge must never be allowed to reaccumulate or much gain will be lost.

Ulcerations require local stimulation by a strong solution of nitrate of silver or a superficial application of the flat surface of the galvano-cautery heated to dull redness. Necrosed bone should be removed, and it is often found detached in the nostril.

Local stimulants should be judiciously combined with alteratives. Powders of nitrate of silver in starch, varying in strength from 1 to 10 grains to 2½ drams (0.06–0.6 to 10.0) of the latter, may be blown into the nostrils by means of an insufflator. Cover gently the whole surface with a thin layer, and use it only of sufficient strength to be slightly felt. Nitrate of silver in solution, 1 to 10 grains to 1 fluidounce (0.06–0.6 to 30.0) gives better results at other times when applied to the mucous membrane. The physician must avoid overstimulating, and so exhausting the glands which it is wished to strengthen. The use of alteratives may alternate with the silver salt and iodide of potassium, and this may be done by using solutions of *iodine* and *glycerin,* as recommended for hypertrophic nasal catarrh. Neo-silvol is useful and painless. *Internally,* we may employ iodide of potassium, to increase nasal secretions, and mucous-membrane stimulants and tonics. Attention should also be paid to the activity of the skin. (See Scarlet Red, Part II.)

NASAL CATARRH (CHRONIC).

Chronic nasal catarrh is essentially a disease of civilization, which may occur at any period of life, but more commonly develops from youth to early adult life.

Although very prevalent among the upper classes, it is in the lower ranks that it most frequently reaches its later stages and its worst forms. This does not result from lack of opportunity for treatment, but from the ignorance or indifference which this class show to diseases while there is no suffering and no interference with business.

Hypertrophic nasal catarrh commonly has its origin in a neglected cold in the head or in a series of colds occurring in rapid succession, keeping the nose in a congested state until the erectile tissue covering the turbinated bones loses in a measure its power of contracting, and, decreasing the caliber of the nostrils, becomes a source of permanent obstruction to breathing.

As the disease advances there is increased susceptibility to cold.

Slight exposure produces a stuffy feeling in the nose. The nostrils may become completely occluded; usually, however, only one side at a time is obstructed at first, the obstruction showing a tendency to change sides. This change is most noticeable on turning in bed, the lower side usually stopping, and on changing the posture the obstruction is reversed, the clearing being accompanied by a crackling sensation. A slight tickling cough and tendency to clear the throat in the mornings may result from irritation of the pharynx or larynx.

The first indications for *treatment* are the reduction of inflammation and restoration of the breathing-space.

As the chief function of the nose is respiratory, the reëstablishment of free nasal respiration, combined with the liberal use of antiseptic washes, will lessen the inflammation and irritation and produce a healthier state of the secretions.

The writer places *cleanliness* at the head of the list of remedial measures. The alkaline wash recommended for coryza, sprayed into the nose by a hand atomizer or gently snuffed from the palm of the hand or from a small cup, gives good results. The hand warms the solution slightly, but when snuffed from a cup the solution should be artificially warmed. This wash may be used two or more times a day, blowing the nose without compressing the nostril.

The nasal douche should never be used where there is nasal obstruction, on account of the risk of forcing the solution into the Eustachian tube and causing infection of the middle ear.

A little later a spray of ferric alum, 5 grains to the ounce (0.3–30.0), may be applied carefully in an atomizer by the physician. It is not advisable to use alum in any considerable strength in the nose, as its continued use is liable to impair the sense of smell.

The alterative and absorbent action of *iodine* makes it a valuable remedy for local application in very chronic nasal catarrh. It should be combined with glycerin in the strength of 6 or 8 grains to the ounce (0.4–0.5 to 30.0), with enough potassium iodide to make a solution. Apply this by means of a piece of absorbent cotton on the end of an applicator, along the floor of the nose, until it reaches the pharynx. It is needless to say that such an application as this should be made with the utmost gentleness. The cotton should project beyond the probe, and care should be taken to avoid bruising the tissues.

After the irritation has subsided, as shown by the disappearance of the livid color and lessened sensibility, any remaining hypertrophied tissue should be removed by a competent rhinologist.

NEPHRITIS (ACUTE).

In the early stage of onset, for the reduction of inflammation circulatory depressants are to be resorted to, and aconite is generally most serviceable. The patient should be kept quietly in bed and given a milk diet, and hot compresses, cups or leeches used over the renal regions if the urine is scanty. Blisters are not advisable, as the substances producing them may be absorbed and cause increased renal irritation. The restlessness will generally be quieted by the aconite; but if this fails, resort must be had to bromide of sodium or small doses of opium, which must be given cautiously, as these drugs are not readily eliminated when the kidneys are diseased. Cannabis is thought to be of great service if bloody urine is present, but chloral is generally too irritating to the kidney to justify its employment. Albuminous foods are to be avoided and nutrition maintained by easily digested cereals aided in digestion by the use of taka-diastase. The common resort to a rigid milk diet is questionable. It contains too much protein and too much water for its caloric value. Fruit juices are useful. Arrow-root starch is one of the best cereals for these patients because of its low protein content. A minimum of salt is allowed as there is a tendency to retention of chlorides.

Should the urine be scanty and of high specific gravity, and constipation be present, some calomel, followed by a purgative dose of (½ ounce [16.0]) of sulphate of magnesium should be used to aid in the elimination of impurities by the bowel. Warm mucilaginous drinks, as flaxseed tea, are of service, and the use of sweet spirit of nitre with moderate use of pure water should be resorted to increase urinary flow and promote the action of the skin. It is not to be forgotten, however, that an inflamed organ needs *rest,* and the too free use of water and diuretics, particularly the potash salts, may be distinctly harmful, yet this is a common error.

If symptoms of uremia (see Dropsy and Uremia, Part IV) come on, hot-air baths or hot packs are often useful to provoke sweat and are much safer than pilocarpine. A general hot pack is contraindicated if the breathing is oppressed or if there are any rales at the base of the lungs. A good result can be obtained by applying a limited hot pack made by using a hot wet blanket folded so as to cover the body from the level of the diaphragm to the middle third of the thighs. (See Heat, Part III.)

It is not to be forgotten that all cases of acute nephritis are caused by some form of infection, usually a streptococcus or by irritant poisons. All sources of focal infection should be sought after with the idea of removing them when partial or complete recovery from the acute condition has passed, but operative procedures are contraindicated, as a rule, during the height of the inflammatory process, because if infected tonsils, sinuses or teeth are the primary cause their disturbance may cause a sudden increase of bacterial invasion. When a septic focus can be readily opened and drained this danger does not exist.

NEPHRITIS (CHRONIC).

The treatment of chronic nephritis is a very different matter from that devoted to the cure of the acute form. It is really a degenerative change, not an ordinary inflammatory process. It is quite impossible to cure the condition present, and we can only strive to improve the state of the kidneys, and other organs, by diet and the use of proper drugs. To arrest the disease all alcoholic drinks should be avoided as far as possible, business care and worries be cast aside and the patient sent to a warm climate.

In both forms of chronic nephritis diet and mode of life are more important than the use of drugs although the latter are at times important adjuvants. In parenchymatous nephritis it is true that a milk diet fortified by cereals and vegetables in general is generally indicated, but it is important to bear in mind that a strict milk diet is unwise, because to obtain a sufficient number of heat units or calories in each twenty-four hours, a patient would have to ingest not less than 4 quarts of milk and thereby flood himself with fluid which his kidneys cannot get rid of because in this type of renal disease a lack of ability to excrete water is practically a constant state. Furthermore, the patient receives a relative excess of protein and a minimum of carbohydrate and cannot maintain a nutritional balance. As he cannot take 4 quarts of milk a day he starves and so uses his own tissues to support life, thereby becoming weaker and giving his eliminating organs the task of getting rid of the educts of his own tissue breakdown. In one of the earlier editions of this book the writer advanced the theory that when profuse albuminuria is present, a diet containing a fair amount of protein is needful to compensate for heavy loss of albumin and I note with interest that this view has recently been advanced by others. Moderate amounts of protein food are, therefore, often advantageous. Indeed at times large amounts of protein are ordered not only to replace the loss of large quantities of albumin in the urine, but because it has been shown on the one hand that they increase the patient's strength and on the other that they do not in many cases increase the non-protein nitrogen in the blood. Lowered blood protein also predisposes to dropsy and no less an authority than Epstein insists on a full protein diet in dropsy since such treatment is followed, at least in some cases, by increased diuresis. Epstein goes further than this and urges the free use of thyroid gland with the idea that it hastens protein metabolism. It would appear that chronic parenchymatous nephritics can take thyroid in large amounts with impunity, that is without greatly increasing their metabolic rate. The use of a skimmed milk diet is unwise because the patient is deprived of the nutritious cream to which there is no objection but value. The old idea that red meats are more harmful than white meats I have long taught to be untrue.

Chronic parenchymatous nephritis cannot be treated by routine, but each case must be studied as to its needs. These needs are not based so much on the albumin and casts in the urine as upon its other organic and inorganic content and the state of the blood. During an acute exacerbation a skimmed milk diet for a few days may be wise, but as a general routine throughout the case, diet must be fitted to the patient's nutritive and eliminative needs. Even if the urine is not in full amount it may nevertheless contain almost the normal amount of solids. That is, the water excretion may be the chief function impaired, and to push the ingestion of water, as is often done in such cases, is obviously unwise. In addition to measuring the output of urine, the intake of water should be estimated. The last is rarely done.

An accurate method to determine the ability of the kidneys to excrete water is that of Voille.

The patient must be kept in bed, or be kept out of bed, because the test is influenced by posture and the conditions at each time of record should be the same. The bladder is emptied at 7 A.M. and 200 cc. of water ingested at half-hour intervals for 4 doses. Each time a dose of water is swallowed the urine is measured and at half-hour intervals for three hours after the last dose.

Voille gives the following table as a normal result:

Time (A.M.).	Water taken, grams.	Urine collected. grams.
7.00	200	
7.30	200	35
8.00	200	60
8.30	200	180
9.00	...	300
9.30	...	220
10.00	...	35
	800	830

If more than 35 cc. are passed at 7.30 it is probably due to delayed night secretion. If the totals are largest at 9.30 and 10 excretion is delayed also. If the maximum totals are so delayed that they are not reached for five to six hours the delay in water elimination is still more indicative of renal inability to excrete water.

The excretion of solids can be roughly estimated by Long's method of calculation of solids. This consists in taking the specific gravity of the twenty-four-hour urine and its quantity, which we will suppose is 1 liter. Multiply the last two figures of the specific gravity by 2.6. Thus if the specific gravity is 1.014 we will get as a result 36.4 grams of solids, whereas the normal output should be about 70 grams, but if the patient is at rest and on a limited diet 36.4 grams is not unduly low.

A very good conception of renal efficiency can be obtained by the method of Mosenthal. (See page 927.) In parenchymatous nephritis the specific gravity is fixed and high ranging as a rule in the twenties.

There is no justification in putting a patient upon a salt-free diet if there is no retention of chlorides. If there is retention the patient becomes dropsical in some cases because he retains salts to maintain the tonicity of his body fluids. The urine in such cases should have its chlorides estimated for twenty-four hours. During the next twenty-four hours about 5 grams of salt are added to the ordinary intake of food and the urine tested during the following twenty-four hours. Kidneys capable of secreting chlorides should get rid of this excess of salt in twenty-four hours. If little of it escapes then the intake of salt in food should be decreased because it is evident that this function of the kidneys is impaired. In some instances, however, the transudation of fluid is due to an increased permeability of the vessel walls. (See Dropsy.)

So, too, with meats, if a blood analysis reveals a non-protein nitrogen content of less than 40 milligrams per cent it may be inferred that nitrogen retention is not in excess and protein foodstuffs are permitted in moderation. If, however, the non-protein nitrogen is above this figure and the creatinin is above 2.0 the proteins should be cut down or forbidden.

Hot packs are not useful in parenchymatous nephritis if dropsy is present. They are prone to be depressant and to cause pulmonary edema. The amount of water lost is negligible and only about 3 grams of nitrogen escapes through the skin, whereas 8 grams can escape through the bowel if a purge is used (see below).

So far as drugs are concerned in parenchymatous nephritis it may be said that they have a limited value. The use of diuretics, even if they are efficient, which they often are not, is not wise if dropsy is due to salt retention. If the urine is scanty because a failing heart does not give the kidneys enough blood, digitalis is a useful indirect diuretic and if the arterial tension is high the nitrites are also useful. Liquor ammonii acetatis is a useful diuretic in some cases given in the dose of 2 to 4 drams (8.0–16.0) three or four times a day. Most of the good achieved from the use of Basham's mixture depends on the ammonium acetate, for the iron is in excess and the anemia is toxic in origin and the iron does not remove its cause. Minute amounts of iron may do good for the associated anemia but it does not affect the kidneys. When the kidneys are able to excrete salts a useful drug is bitartrate of potassium, 1 ounce or more in 1 pint of water to be drunk as a beverage during the twenty-four hours. Often this dose also purges the patient. When dropsy is present blue mass (10 grains) with compound extract of colocynth (10 grains) may be used, or elaterium ($\frac{1}{6}$ grain) or compound jalap powder in the dose of 40 grains (2.6). These hydragogue purges are, as a rule, contraindicated if there is salt retention, because the body is endeavoring to retain water to maintain the normal tonicity of its fluids. In all these cases sources of septic infection should be eliminated if possible but it is to be recalled that such patients are bad operative risks particularly if nasal accessory sinuses are the site of infection.

In interstitial nephritis albumin is scanty, the specific gravity low because of the polyuria and the low elimination of solids, and nocturnal polyuria is usually present, the kidneys apparently endeavoring by extra endeavor at night to excrete solids that they could not get over the raised renal threshold in the diurnal period. The same dietetic rules hold here as in parenchymatous nephritis but the polyuria prevents dropsy which rarely appears unless the heart fails, that is the dropsy is cardiac not renal. A salt-free diet is therefore not so necessary as a rule. Here again Long's method may be used to gain an idea of renal efficiency and examination of the blood for non-protein nitrogen is even more important in determining about the use of proteins.

It is to be recalled that a certain amount of protein, usually about 1 gram per kilogram of body weight is needed for nutritional balance, but the protein as a rule should not exceed this amount and cutting it down for a few days is often advantageous. Green vegetables, starches, and fruits are useful. (See Diets of the Sick.)

If a normal man is placed upon a moderate diet and allowed about 1700 cc. of fluid in twenty-four hours, no fluid being allowed after 5 P.M. until 8 A.M., he will usually pass about 250 to 500 cc. on arising, about 800 cc. during the day and lose the balance in sweat and respiration. If he has interstitial nephritis, and this holds true in some cases of parenchymatous nephritis as well, he will pass a greater amount during the night or in the morning than normal. Further, in the normal man if the urine be passed at two-hour intervals during the day it will be found to vary quite considerably in specific gravity each time, because the kidneys adjust themselves to the needs of the body from time to time, whereas with chronic contracted kidneys the specific gravity is prone to be almost fixed and low, and in parenchymatous nephritis fixed but high, the kidneys having no elasticity as to function, that is the organs are lame, and care in the diet and caution as to exercise with its increased tissue waste is to be exercised. In interstitial nephritis the nitrites, say 1 grain of sodium nitrite four times a day, may do good by lowering arterial tension and so saving the heart from excessive labor, but it is not to be forgotten that in many cases a high blood-pressure is essential to maintain the circulation through narrowed and tortuous vessels. If the patient does not do well under such treatment he should have rest to improve the vigor of his heart and receive tonic doses of digitalis. In most of these cases avoidance of great mental activity, an easy life and the frequent use of electric cabinet baths will do more for the patient than any other measures. When these baths cannot be obtained the use of the hot packs may be resorted to. (See Heat, Part III.) Residence in a warm climate, where there are not marked changes in the temperature with high winds, is to be ordered so that the skin may be kept active and that the surface of the body be not chilled with resulting congestion of the internal organs. When there is a syphilitic history or a rheumatic or gouty diathesis the iodide of sodium in 15-grain (1.0) doses three times a day is often a valuable aid, the sodium salt being more easily dealt with by the kidneys than the salts of potassium and not so harmful if retained, whereas the potassium may be in itself depressant when used for a long time.

NEURALGIA.

Like headache, neuralgia gives rise to much of the suffering experienced by active persons who are not sick enough for bed. It affects people in every walk of life, and may be so severe as to incapacitate the most powerful man.

The causes of neuralgia are very various, but they may be briefly stated to depend chiefly upon malnutrition and anemia, overwork, nervous excitement with consequent reaction, and upon reflex irritation from diseased organs, as in the case of supraorbital neuralgia from eye-strain or pelvic neuralgia from ovarian irritation or uterine inflammation. Decayed teeth or pyorrhea alveolaris may be a cause as may infection of one of the sinuses of the head. Nerves functionally diseased are always *more* or *less* active than normal; that is, *hyper*-excited, or depressed, above or below par. In both cases they must be brought back to their normal tone by appropriate remedies, and these consist in nervous excitants and nervous sedatives. To give a nerve already depressed the additional depression of a bromide, or a nerve excited the additional excitement of strychnine is harmful.

From what has just been said, it becomes evident that the physician must always determine the condition of the system of his patient and the causes of the neuralgia before administering remedies.

The treatment of neuralgia, from its curative standpoint, may be divided into the use of tonics, laxatives, nutritives, and palliatives. (See Migraine.)

Where neuralgia is associated with anemia no hope of permanent relief can be looked for unless iron and arsenic are used until the anemia is cured, and it is often necessary to combine with these drugs the use of cod-liver oil and bitter tonics. These are the cases, too, in which nux vomica and strychnine raise the depressed nerves to increased activity, and so bring relief. How they do this is not known, but we know enough to recognize one or two important facts. Strychnine is certainly a nervous stimulant, and is also a stimulant to the anterior columns of the spinal cord. It probably also acts upon the trophic centers in the anterior cornua of the spinal cord, and by stimulating these centers increases the nutrition of the tributary nerve-fibers.

It is needless to state that the neuralgias of syphilis and tuberculosis are to be treated by the remedies usually directed to the relief of these affections, while at the same time the pain itself is carefully controlled by appropriate palliatives.

When nervous exhaustion causes neuralgia, glycerophosphates and cacodylate of iron and sodium are useful remedies, particularly in those cases which are convalescing from acute fevers.

Sometimes malarial poisoning produces a violent form of supra-orbital pain known as "brow ague," which is to be relieved, not by ordinary remedies, but by large doses of quinine.

The relief of the states producing neuralgia having been spoken of, it yet remains to consider the measures to be adopted for the cure of an attack. Fortunately the recent advances of therapeutic study have placed in our hands a large list of drugs not apt to produce a habit after prolonged use, comparatively safe though active, and not of disagreeable taste or evil general effect. By these terms the writer refers to antipyrine, acetanilid, acetylsalicylic acid and acetphenetidin, all of which possess wonderful power in the alleviation of pain dependent upon true nervous involvement. In order to avoid failure in the use of these drugs in the relief of headache, we must always remember that their field of service is that of neuralgic pain, not other pains. Antipyrine is to be used in the dose of 5 to 10 grains (0.3–0.6) for ordinary neuralgia and more for the pain arising from the crises of locomotor ataxia, acetanilid in the dose of 3 to 8 grains (0.2–0.5) for the same purposes, and acetylsalicylic acid and acetphenetidin in the same amount as antipyrine. Acetylsalicylic acid in tablet or capsule in the dose of 5 to 20 grains (0.3–1.3) is very efficacious. (See Allonal and Peralga.)

Upon these remedies combined with caffeine and the bromides according to circumstances, we may depend, and the following prescriptions will be found of service:

℞—Antipyrinæ	gr. xxx vel ʒj (2.0–4.0)
Caffeinæ	gr. xx (1.3).—M.

Fiat in chartulas, No. x.
S.—One every thirty minutes until relieved or six doses are taken.

The following may be of use also:

℞—Antipyrinæ	gr. xxx vel ʒj (2.0–4.0)
Potassii bromidi	ʒiij (12.0).—M.

Fiat in chartulas, No. x.
S.—One every thirty minutes in water until three doses have been taken.

Or, when the caffeine in the first prescription causes nervousness—

℞—Antipyrinæ	gr. xxx vel ʒj (2.0–4.0)
Caffeinæ	gr. x (0.6)
Potassii bromidi	ʒiij (12.0).—M.

Fiat in chartulas, No. x.
S.—One as above.

In any one of these prescriptions acetanilid or acetphenetidin may be substituted for antipyrine, and they should be used in preference to it if the heart is weak.

Full doses of gelsemium may be used.

A very effective remedy in some cases of neuralgia of the fifth nerve is croton chloral in from 5- to 20-grain (0.3–1.3) doses in pills or capsules of 5 grains (0.3) each.

In certain cases of anemic neuralgia of the head nitrite of amyl inhalations have proved useful, probably by reason of the cephalic flushing produced by this drug.

In some cases repeated doses of castor oil, $\frac{1}{2}$ to 1 ounce (15.0–30.0) a day, seem to exercise a very extraordinary influence in relieving neuralgic pain. Such cases probably depend upon deficient activity of the bowel with retained toxic material which gains access to the blood. (For Migraine, see article on that subject.)

A very useful hypodermic injection in severe neuralgia is $\frac{1}{8}$ to $\frac{1}{4}$ grain (0.007–0.015) of morphine, but the danger of beginning the morphine habit is to be remembered when treating chronic cases. Sometimes the surgeon may be called upon to do a neurectomy.

A very large number of local applications have been used with success in obstinate neuralgias and other cases not so difficult of cure. Cocaine cannot be applied, as it does not penetrate the skin, but relief can sometimes be obtained by the local use of a menthol pencil rubbed over the spot if it be superficial. Correction of eye-strain by glasses may relieve cephalic neuralgia.

Where the nerve is very superficial it can often be treated by cold with great success. This is accomplished by freezing the parts with an ether, chloride of ethyl, or rhigolene spray, or by the application of a small piece of ice covered with salt to the part.

Sphenopalatine neuralgia is to be treated by applying pure procaine to the ganglion or by injecting alcohol by the method of Sluder or again by frequent applications of nitrate of silver solutions after procaine is used. All these applications require that the middle turbinate body be removed so that a free passage to the ganglion may be had.

OBESITY.

Whenever an excess of fat accumulates in the body, various discomforts, both mental and physical, arise, and in addition the normal functions of all the parts are so disturbed or interfered with that the continuance of health is often impossible. In many cases the deposition of fat about the heart or between its fibers results in serious symptoms; and breathlessness on exertion is produced by the obstruction which is offered to the free movements of the diaphragm by masses of omental fat, aided by the fact that the great weight and bulk of the body requires severe muscular effort. It is worthy of note, also, that a layer of fat over the body increases the vascular surface very greatly, and in consequence gives the heart the labor of supplying a larger number of bloodvessels.

In many families there is an inherited tendency to obesity, while in others only certain individuals are affected. These persons are fat because their bodies naturally tend to the deposit of obese materials, in the same way that the members of one family have large bones, while those of another have a small frame. The etiological causes of obesity, outside of those just named, are numerous, but the chief one is overindulgence in food, probably associated with some disorder of the thyroid, pituitary, and other glands of internal secretion.

It is not out of place to state exactly what overindulgence in food means. Every individual is a law unto himself in regard to the amount of food which is ingested and consumed. One often sees large, powerful, wiry men, who eat little, stand beside others, not so powerful or large, who eat excessively, and who apparently do not suffer from indigestion in consequence. Neither of these groups becomes excessively fat, because one represents a grate which burns its fuel so that there is no waste, while the other resembles a grate in which there is always a residue of unburnt coal which is cast out with the ashes as effete matter. As different engines of the same build require varying amounts of coal, so do different men assimilate different amounts of food. No stated amount of food can be set down as a man's daily portion until his case is carefully studied, but it is important to remember that the quantity of food is generally in direct ratio to the severity of the toil, and that a man who loiters about a club or "takes life easily" often eats more than a day laborer—of far richer foods, too—and wonders why he gets stout. In nearly every case of obesity not dependent upon gross disorder of nutrition overindulgence in food is the cause. To some this may seem absurd, and the patient will say that he eats just enough to keep him from feeling empty between meals; but this does not alter the case in the least. The proper amount of food for a man is not what his appetite or gastric viscus calls for, but what his system needs. To this further reference will be made when considering the diet for obesity, found below.

The very presence of fat aids in the deposition of it, for, by acting as a non-conducting pad all over the body, it prevents the dissipation of heat, and so decreases the combustion of those substances which, when not used for the manufacture of heat, are deposited as fat. Again, we find that obese persons often take alcohol with their food, thereby increasing the fat in their bodies; for, finding that they cannot digest all the substances which greediness makes them swallow, they take alcohol to stimulate their digestive apparatus to increased efforts and assimilation. Further than this, alcohol adds force to the body, and preserves the tissues by substituting itself for food in the oxidizing processes.

We find, therefore, that three great causes are active in producing corpulence in many cases—namely, heredity, overindulgence in food, and lack of exercise, which is one of the means by which overindulgence is produced; *i. e.*, less exercise, less food needed, but often more eaten. (See Section on Feeding the Sick.)

The treatment of corpulence rests solely upon the conditions named. In all instances the diet is the important point for the bestowal of care. Reference has already been made to the fact that the needs of the system are the criterion by which should be determined the amount of food necessary to each case, not the sensations in the stomach.

Obesity, not due to disorder of the pituitary (intrinsic obesity), is due to overeating with lack of exercise, the result being an increase in anabolic processes without a corresponding catabolism to make a nutritional balance. The very increase in weight predisposes to less exercise. If this balance is persistently disturbed a time comes when the body having stood all it can in the way of food finds it necessary to get rid of excess by eliminating sugar in the urine, explaining the well-known fact that obese persons are potential diabetics; first glycosurics and then, when the pancreas breaks down in function under stress, pass into true diabetics. Some idea of the need of treating the obese as if they are actually in ill health can be gained by the sugar tolerance test. It is generally conceded that the fasting blood sugar should be about 0.08 to 0.10 milligrams per cent. If 50 grams, or 1.75 grams per kilo, of dextrose are given by the mouth on an empty stomach there is always a sharp rise of blood sugar in a normal person to 0.18 to 0.20 but at the end of one and a half hours it drops down to normal. In some obese persons the rise in blood sugar is up to 0.23 or even 0.36 and the normal level is not reached in less than two or three hours, showing that the body cannot readily store it. Furthermore sugar is often found in the urine. Those facts not only enable us to determine how necessary it is for the physician to insist upon the patient being careful as to his diet, but clearly indicate that not only must he cut down on carbohydrates, proteins, and fats, to a level consistent with maintenance of nutrition (See Feeding the Sick, page 684), but that he must take exercise to catabolize the food he ingests and possibly the excess he has stored. As alcohol is often used by these patients it must be cut out, as by being easily oxidized it spares the fats and carbohydrates which should be used up in the expenditure of energy.

Persons who are obese and wish to lose flesh are prone to sharply starve themselves and take more exercise than is wise. They have gotten fat slowly they should get thin slowly. Nutritional processes should be adjusted, not upset by sudden change of habit. A loss of 3 pounds a week if constant is usually all that is safe if the patient is not to suffer.

The patient should not be too heavily clad, either day or night, should resort to exercise, daily becoming more active, and should not drink freely of water, unless sweating is established sufficiently freely to prevent the accumulation of liquid in vessels and tissues.

Very often a cold bath will, by its dissipation of heat, causes destruction of fat, which will be burnt up in the body in the production of heat-units to maintain the temperature; and if the patient is not too anemic and stands this exposure to cold well, the bath should be repeated each day or a Turkish bath followed by a cold plunge used instead.

The food of the patient suffering from obesity is to be arranged so that, though its bulk be great, its nutritive properties are small. Beef and other meats are concentrated foods containing much nourishment in a small bulk, while lettuce, spinach, cabbage, and nearly all vegetables, except roots or tubers, contain a large amount of fiber useless to the body. By the use of a carefully arranged vegetable diet in obesity we cut down the actual amount of food absorbed, and by its bulk keep the stomach so busy at sifting the nutritious from the non-nutritious materials that hunger is not felt, because another meal-time is reached almost before the food of the first is assimilated. We find, therefore, that the diet for the reduction of corpulence should consist chiefly of bulky vegetables, but not too exclusively of any one article or set of articles. Heretofore it has been thought that proteids (meats, eggs, etc.) should be used to take the place of all hydrocarbons or carbohydrates (fats, starches, and sugars), but this is not physiologically correct, as all forms of food are always needed for health, and it has been found that proteids may be converted into fats in the body. For a discussion of the needs of the normal body the reader is referred to opening remarks in that part of this book entitled "Feeding the Sick" and to the article on Diabetes in Part IV, it being remembered that the total number of calories for an active man of 150 pounds is in the neighborhood of 3000, or about 40 to 50 Calories per kilo (2.2 pounds). The relative proportions are 400 grams of carbohydrate (1600 Calories), fats 125 grams (1125 Calories) and proteins 125 grams (500 Calories), a total of 3225 Calories. When obesity is to be reduced by diet such a total may be in excess, all these amounts may be wisely cut down, remembering that about 50 to 70 grams of protein are needed to compensate for nitrogenous loss and a fair amount of carbohydrate must be used to aid in oxidizing the fats.

The following bill of fare will be found of service in the treatment of obesity.

Breakfast: One or two cups of coffee or tea, without milk or sugar, but sweetened with a fraction of a grain of saccharin. Three ounces of toasted or ordinary white bread or 6 ounces of bran bread. Enough butter may be used to make the bread palatable—not more than 1 ounce. Sliced raw tomatoes with vinegar or cooked tomatoes without any sugar or fats. This diet may be varied by the use of salted or fresh fish either at breakfast or at dinner. This fish must not be rich like salmon or sword-fish, but rather like perch or other small fish.

Noon meal (dinner): One soup-plate of bouillon, consommé, Julienne, or other thin soup, or oyster broth, followed by one piece of the white meat of any form of fowl or a small bird. Sometimes a small piece, the size of one's hand, of rare beef or mutton, but no fat, may be allowed, and this should be accompanied by string-beans, celery (stewed or raw), spinach, kale, cabbage, beans, asparagus, leeks, and young onions. Following this, lettuce with vinegar and a little olive oil (to make a French dressing), a cup of black coffee or one of tea, and a little acid fruit, such as sour grapes, tamarinds, and 2 oranges, or lemons, may be taken, and followed by a cigar or cigarette.

Supper should consist of 1 or 2 soft-boiled eggs, which may also be poached, but not fried, a few ounces of bran bread, some salad and fruit, and perhaps 1 or 2 glasses of light, dry (not sweet) wine, if the patient is accustomed to its use.

Before going to bed, to avoid discomfort from a sensation of hunger during the night, the patient may take a meal of panada, or he may soak Graham or bran crackers or biscuits in hot water and flavor the mass with salt and pepper.

The bowels should be kept active by the use of laxative fruits or purges, but if liquids taken in drink are not eliminated rapidly, saline purges are useful, since if the bloodvessels are engorged, the circulation in the capillaries is slow and a deposit of fat is apt to result.

Where proper exercise is impossible the rest cure, with massage, electricity, passive exercise, iron and arsenic, and an absolute skimmed-milk diet, may be resorted to, particularly in those persons known as "fat anemics," who have not enough red corpuscles in their blood to carry sufficient oxygen to the tissues to complete oxidation.

So far as medication is concerned, the value of the thyroid gland in some cases is not to be forgotten, particularly if any signs of hypothyroidism are present. (See Thyroid Gland, Part II.)

No attempt is made in this article to discuss the types of obesity due to endocrine disorders, notably of the pituitary body. The drug therapy of these cases is relatively limited, but it is probably true that use of the metabolimeter will show in exogenous obesity little change in the normal metabolic rate (10+ or 10−) whereas in endogenous obesity metabolism, if due to deficient thyroid, will be subnormal, therefore indicating the use of thyroid gland. (See Thyroid Gland, Part II.) If thyroid gland is used to decrease weight it is best to watch its effect on the heart, blood-pressure, the weight, to frequently use the metabolimeter and never to raise the metabolic rate above 10+ by its use.

OPHTHALMIA (SYMPATHETIC).

This term is applied to an inflammation of the uveal tract (iris, ciliary body and choroid) of one eye, due to the effects of a similar inflammation of the other eye.

The most usual lesions which produce this affection are wounds in the ciliary region, passing through "the danger zone," about one-fourth of an inch wide, surrounding the cornea, beneath which lies the ciliary body, followed by an infective iridocyclitis; retained foreign bodies within the globe, which have created an iridocyclitis; perforating wounds or ulcers, with prolapse and incarceration of the iris, or scars involving the ciliary body. It occurs more commonly in children and young persons than in those of maturer years, but no age of life is exempt. The eye primarily thus injured is called the "exciting eye;" the fellow eye, to which the inflammation is transferred, is called the "sympathizing" eye. In general terms sympathetic ophthalmia is likely to occur if a plastic uveitis (iridocyclitis) arises as the result of a penetrating wound of the cornea or sclera, especially in the "danger zone," associated with prolapse of the uveal tissues or incarceration of strands of lens capsule. Save in rare instances, the minimum time which elapses between the date of injury and the development of sympathetic ophthalmia is fourteen days; it must be feared during the first twelve weeks after injury, especially between the sixth and twelfth weeks; it is uncommon after this period.

The affected eyes should be treated with atropine, as in all cases of iritis, unless there is rise of tension. Mercury internally, or by inunction, is usually advocated and should be tried, but a remedy of great value is salicylate of sodium in very large doses, as much as 1 grain (0.065 gm.) of this drug daily for each pound of body weight. As these large doses cannot always be borne, 60 to 100 grains (3.9–6.5 gm.) per diem in adults may be given. In place of the salicylate, acetylsalicylic acid may be employed in very large doses. Arsphenamine and neoarsphenamine have been used with good effect. Other drugs which have been recommended are phenylcinchoninic acid (40–60 grains, or 2.6–3.9 gm. daily) and benzosalin in full doses. Verhoeff has advocated foreign protein therapy by large doses of antidiphtheritic serum and reported good results. Alan Woods, having experimentally shown that the development of an immunity to pigment protects against sympathetic ophthalmia, while the development of a tissue hypersensitivity to pigment is associated with the disease, has, treated cases of sympathetic ophthalmia by injections of uveal pigment, that is, the treatment consists in desensitization with the pigment and subsequent continuance of the injections until a state of immunity is produced. It is urgently necessary that an eye injured as described should be kept under expert observation until all danger is past. Prophylaxis comprises the treatment of the eye originally injured, and *preventive enucleation*, if treatment is unavailing and sympathetic ophthalmia is threatened.

PERICARDITIS.

If the case be sthenic and is seen early, and the heart is over-acting, five to ten leeches or several small fly blisters should be placed over the precordium. An ice-bag placed over the precordium not only relieves the pain, quiets the circulation, and reduces the temperature, but also acts favorably in modifying the severity of the inflammation.

Where the case passes from the acute stage of inflammation to that in which effusion takes place, or if the patient is already depressed by illness, the treatment becomes supportive if the circulatory system shows signs of failure. The friction-sounds of the first stage are now lost, and the heart-sounds may be feeble or muffled by reason of the effusion present. Digitalis, alcohol, or caffeine may be used if the heart shows signs of failure. If the effusion is sufficient to endanger life, it should be tapped and aspirated very gradually. Often it is best to tap with a long trocar and cannula, attached to a syringe or aspirator, with a by-pass to one side. (See Pleuritis.) By this means the trocar can be withdrawn so that the heart will not be wounded, whereas the use of a needle with a sharp bevelled edge might do so. The instrument should be inserted gently, the operator feeling his way. Some authorities hold that the danger of wounding the heart is so great that it is best to make an incision. The best places for making the puncture are the fourth or fifth intercostal space, very close to the left edge of the sternum, or in the fifth right interspace, close to the sternum, but West advises the fifth and sixth interspace to the left of the nipple because the effusion pushes the heart upward and the lung to one side. If the tap is "dry" and the physical and roentgen-ray signs of effusion are positive, the posture of the patient should be changed and another trial made. Much aid can be obtained by the use of the roentgen-rays in determining the point for tapping. Often a blister over the precordium is of service in aiding absorption. Should pus be present free drainage must be established by means of an incision, and it may be necessary to excise the sternal end of the fifth rib on the left side.

When an old pericarditis causes adhesions in such a manner as to seriously interfere with cardiac action the operation of cardiolysis is to be considered.

PERITONITIS (ACUTE).

Opportunities for study have shown that peritonitis never arises as a strictly primary condition, but is due in every case to the infection of the peritoneum by microörganisms, benign or malign, which originally are found in the intestines or other portions of the abdominal or pelvic viscera. Even when peritonitis follows directly upon injury, the actual cause of the pathological process is the escape of microörganisms through the devitalized wall of the intestine, and the severity of the attack depends in turn upon the vital resistance of the patient, the virulence of infection, and the rapidity with which a plastic exudate is thrown out to encapsulate the inflamed area.

It is not possible in this article to discuss the facts now known in regard to the etiology and pathology of acute peritonitis. Suffice it to state that the Bacillus coli communis found normally as a benign inhabitant of the intestine becomes at once, on entrance into the peritoneal cavity, malignant and capable of producing rapidly fatal peritonitis. Nor is actual rupture of the bowel or appendix vermiformis necessary for this infection, since it has been shown that this germ rapidly migrates through the bowel-wall as soon as it becomes inflamed or congested in all its coats. Streptococci and staphylococci, finding access to this cavity, also produce violent inflammation. It has been found that the peritoneum will destroy many infecting germs if its vitality is not impaired, but if it *is* impaired, even a mild infection gives rise to severe inflammation.

Having learned, then, that acute peritonitis is always secondary to some local cause or to some general infection, the first thing for the therapeutist to do is to determine what the provoking agent is, in order that his treatment may be directed against the cause rather than the effect. This cause is now known, in the great majority of cases, to be appendicitis (which see), the inflammatory process being spread by infection from this source. In women it is not uncommonly due to more or less obscure pelvic disease. Again, it may arise from abscess and other severe diseases of the liver, spleen, pancreas, or stomach. Finally, it should never be forgotten that intestinal obstruction and perforation are causes of peritonitis. The physician may rest assured that if he cannot find the provoking cause he is not to decide that the case is purely idiopathic.

Having found the cause, treatment is, of course, to be at once instituted, and is medical or surgical—more commonly the latter than the former—since nearly all the exciting causes of this disease are at most only palliated by medicinal treatment, while they can sometimes be removed by surgical interference. Fortunately Nature does much to aid in producing a cure in many cases by limiting the disease through its localization by walls of lymph, so that many cases of peritonitis recover without active medicinal or surgical care. In the pelvis this localization of the process very often takes place, and it is best to defer any operative measures until the temperature is practically normal. (For pelvic peritonitis see Puerperal Diseases.)

If the trouble arises in the appendix vermiformis, this condition may be treated in its early stages by the means suggested in the article on Appendicitis. In many cases of appendicitis requiring operation it is performed too late through the hesitancy of the patient, his friends, the physician, or even of the operator himself; each hour of delay increases the danger of peritonitis. But if general peritonitis has developed it is best to wait until it is walled off.

At the present time each case must be decided upon its individual merits, and the physician or surgeon in giving advice to the family in regard to a well-developed case of general peritonitis should always be careful to let them understand distinctly that the condition of the patient is most alarming, and the chances of life poor whether the treatment be medical or surgical, since in many instances neither form of remedial measure can possibly produce good results. In other words, the relatives should be made clearly to understand that whether medicinal measures or surgical procedures are resorted to, the patient has only a fighting chance. In a case of localized peritonitis due to cholecystitis, or appendicitis, or pelvic trouble in a woman, a waiting policy is better. (See Murphy Drip below and article on Appendicitis.)

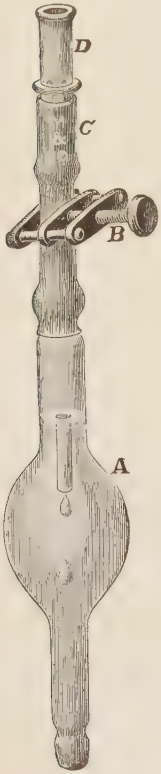

Fig. 127.—Coupling of glass to be put in rubber tubing so as to count the drop-rate. Compressor to regular flow. (Meinecke.)

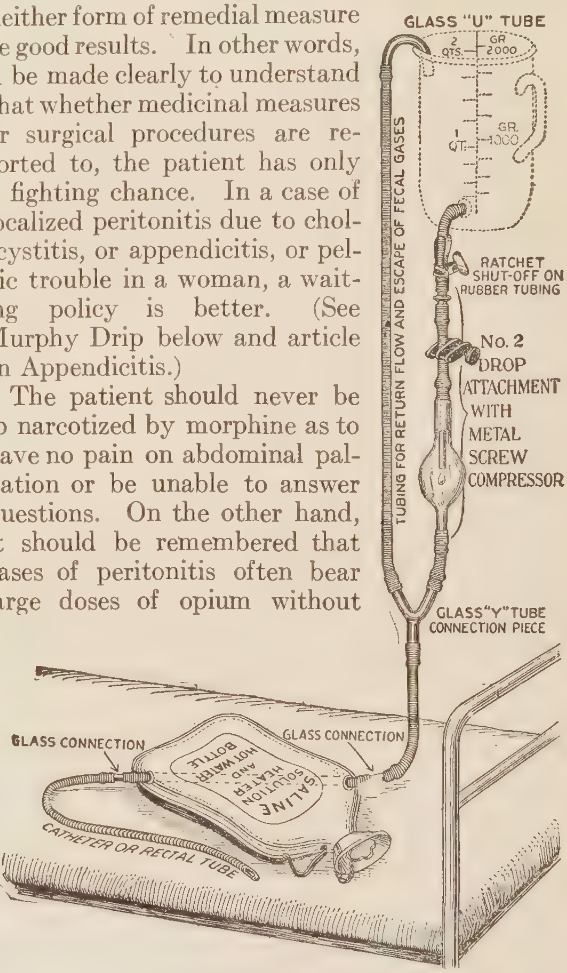
GLASS "U" TUBE
2 QTS.
GR 2000
1 QT.
GR. 1000
RATCHET SHUT-OFF ON RUBBER TUBING
No. 2 DROP ATTACHMENT WITH METAL SCREW COMPRESSOR
TUBING FOR RETURN FLOW AND ESCAPE OF FECAL GASES
GLASS "Y" TUBE CONNECTION PIECE
GLASS CONNECTION
GLASS CONNECTION
SALINE SOLUTION HEATER AND HOT WATER BOTTLE
CATHETER OR RECTAL TUBE

Fig. 128.—Proctoclysis apparatus, consisting of fountain syringe, large rubber tube and rectal tube

The patient should never be so narcotized by morphine as to have no pain on abdominal palpation or be unable to answer questions. On the other hand, it should be remembered that cases of peritonitis often bear large doses of opium without much effect. The dose should be pushed until the desired effect is obtained, and not be measured in grains. (For the proper use of opium, see Appendicitis.)

An ice-bag or a turpentine stupe may be put over the area originating the trouble. Should vomiting be a pressing symptom, it is best controlled by the use of 2 grains of acetanilid given every two or three hours on brandy and ice. Medication is best carried out by the hypodermic needle or the rectal injection. The thirst in many cases of peritonitis is excessive, and may be relieved by Murphy's method (see below). Gastric lavage is often advantageous, particularly if there is vomiting.

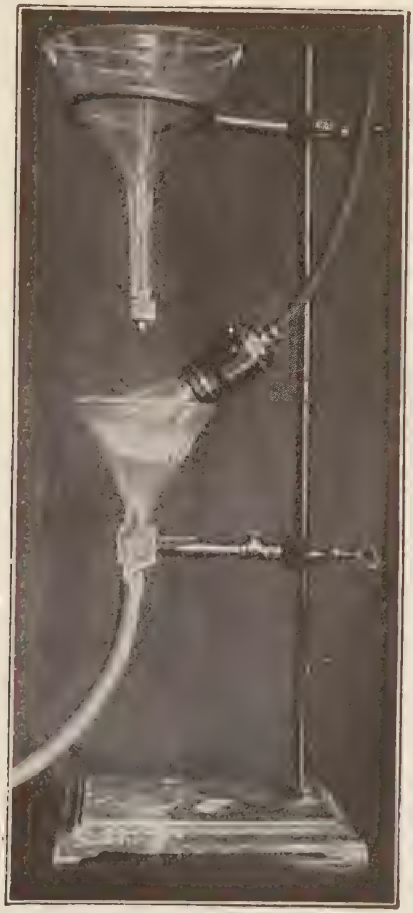

FIG. 129.—Newman's apparatus for proctoclysis.

Postoperative, or septic, peritonitis, which for any reason is inoperable, is best treated by Murphy's method of saline infusion by the rectum. This consists in placing and maintaining the patient in a semirecumbent (Fowler's) position and then introducing slowly, drop by drop, weak salt solution at 102° F. The salt solution is placed in a Wolff bottle, which, in turn, is immersed in a water-bath, the temperature of which is carefully watched. Better still, the apparatus in Figs. 128 and 129 may be employed, the salt solution being frequently renewed. In other instances where a regular apparatus for this form of enteroclysis is not at hand, the scheme devised by Dr. S. Newman, of St. Louis, may be resorted to. (See Fig. 129.) By his plan an ordinary stand, such as is used in pharmaceutical or chemical laboratory, with brackets carrying two funnels, is employed. By means of a piece of rubber tubing attached to the upper funnel, which tubing can be compressed by a pinch-cock, the rapidity of flow from the upper funnel can be controlled. By means of a rubber tube attached to the lower funnel the salt solution is conveyed to the rectum of the patient, and the fluid is heated by placing the bulb of an incandescent lamp in the lower funnel in such a way that it is in part submerged, and the fluid from the upper funnel falling upon it becomes heated. If the saline fluid in the lower funnel becomes too hot the electric current can temporarily be turned off from the lamp. This is best determined by placing in one segment of the tubing an inner tube thermometer (Fig. 130) so that it will be between the hot-water bottle and nozzle in the rectum.

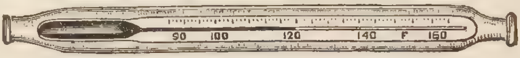

FIG. 130.—Infusion thermometer.

It is essential that the flow of saline solution through the catheter shall be controlled by means of some pinch-cock or other device which will allow the fluid to dribble into the bowel, since if it flows too fast the bowel will become angry and expel it instead of absorbing it. Thirty drops to the minute is the usual maximum.

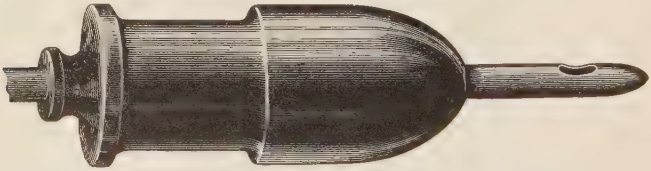

FIG. 131.—Self-retaining tips on catheter, showing how adjustment can be accomplished by merely drawing catheter through to desired lengths.

Murphy advised the employment of a rectal bulb or tip (see Fig. 131), provided with a shoulder, which enables it to be retained in the rectum with ease. This rectal bulb, has a central canal through which a soft-rubber catheter is passed, which catheter carries the saline solution. In those instances in which the rectal bulb causes too much dilatation of the sphincter, and so induces irritation, the ordinary nozzle douche-tip, which is supplied with the commonly employed fountain syringe may be used in its stead. It is exceedingly important that the strength of the saline solution shall be slightly hypotonic (0.5 per cent) instead of that of the tissues—0.8 or 0.9. Stronger solutions will abstract liquid from the tissues instead of being absorbed. If no drop controller is to be had, the vessel holding the fluid should not be elevated more than 6 or 7 inches above the anus, as a very slow delivery of the fluid is desirable. The irrigation is continued for several days in certain cases and the large amount of fluid which is absorbed by the bowel is remarkable. Some patients take as much as 16 pints in twenty-four hours. The theory of this method of treatment is that a reverse current of lymph in the peritoneal lymphatics takes place, so that instead of absorption occurring from the peritoneal surface, the openings of the lymphatics pour out fluid which escapes through the drainage-tube or tubes which are inserted through the abdominal wall. There is no doubt of the therapeutic efficiency of this method, which frequently saves otherwise hopeless cases, but there is doubt of the correctness of this explanation of its usefulness. The Fowler position of the patient aids in limiting the exudate to the pelvis.

The tympanites, which may be a prominent symptom, may be relieved in some cases by the use of the rectal tube or by injections into the bowel of milk of asafœtida or turpentine emulsion. (See Typhoid Fever, Part IV, also Alum, Part II.)

PERITONITIS (CHRONIC).

Chronic peritonitis is very apt to be circumscribed and to exist in connection with chronic appendicular trouble or in females in association with diseases of the organs of generation. The most diffuse and curable form of the disease is that known as tuberculous peritonitis, in which cures have been safely reached through abdominal incision with or without drainage or the dusting in of iodoform. Of all forms of organic disease affecting the abdominal area and of a chronic type, none offer such favorable results to the physician and surgeon as does this, and operation should always be advised and urged upon the patient most strenuously, provided that type of the disease is present in which ascites causing abdominal distention is marked. In that form characterized by matting of the coils of intestines and of the omentum, or large tuberculomata, operation cannot give such good results. Care should be taken, however, to separate the subacute or chronic process, termed tuberculous peritonitis, from the malignant and acute form, called tuberculosis of the peritoneum, which is often only a manifestation of a general miliary infection.

PLEURITIS, OR PLEURISY.

When the pain from the pleurisy is excessive and the respiratory movements greatly increase the discomfort, strapping the chest-wall may be resorted to. This is done for the purpose of immobilizing that side of the chest. The straps should consist of adhesive plaster, two inches wide, and should be long enough to reach from the middle line of the vertebræ to the sternum or a little beyond its middle line the first one being the lowest. They should be applied tightly during expiration, slightly overlapping one another at a right angle to the spine, and not in the line of the ribs (Fig. 132). Sometimes an elastic adhesive bandage called "Elastikon" may be so applied as it makes a less rigid support. Codeine, morphine or Dover's powder may be given.

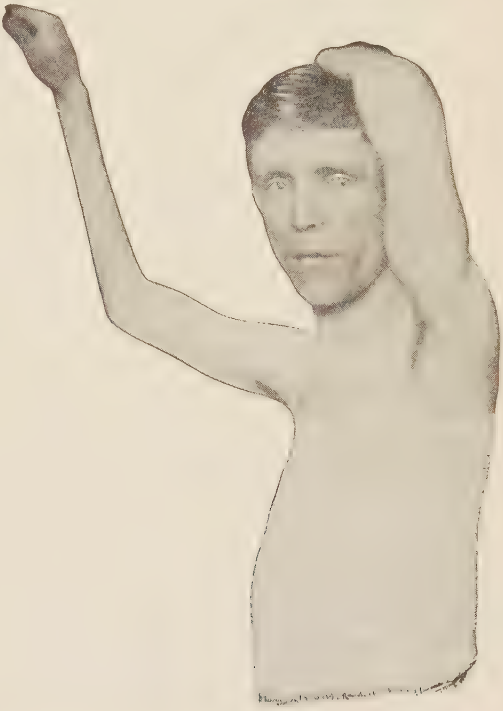

Fig. 132.—Showing the overlapping of the adhesive strips in strapping the chest for painful pleurisy. The strips extend too far to the patient's right. Often only two or three of the lowest ones are sufficient if tightly drawn.

The old idea that pleurisy was usually due to cold rather than to an infecting microörganism led to the practice of enveloping the chest in poultices. These soil the clothing, speedily get cold, and become very uncomfortable. They have been supplanted almost entirely by the cotton jacket, which is not much better. The author never uses either of these dressings. (See Pneumonia.)

When the second stage is reached and a pleural effusion, serous or purulent, has developed the physical signs consist in flatness on percussion over the lower portions of the chest, which area of flatness generally varies with the change in the position of the patient from the erect to the recumbent position, unless the effusion is sacculated. Blowing or bronchial breathing at the apex of the lung, when this organ is compressed upward by the fluid beneath it, is often heard. If the effusion is on the right side, the apex beat of the heart is apt to be displaced to the left. If it is on the left side, there is displacement to the right and there is obliteration of Traube's semilunar space, which is a spot at about the level of the sixth and seventh ribs anteriorly below the nipple, where there is usually a tympanitic note on percussion.

If the effusion is sufficiently large to cause marked dyspnea or reaches to the third interspace anteriorly, it should be removed by aspiration. When the effusion is not causing dyspnea, or other evil symptoms by reason of pressure, that is, it is present in small amounts, the physician should allow sufficient time for recovery to occur; as, for example, a week or ten days, during which interval the system will in many cases remove the fluid by natural processes of absorption if not purulent. If after this time has elapsed the quantity of fluid remains unchanged resort must be had to aspiration of the liquid. Purges ought never to be employed to remove the fluid, as they weaken the patient, and they are futile because the pleural surfaces are covered by a fibrinous exudate which prevents absorption.

There is no danger in aspiration if it is properly performed. The best place to insert the needle is the sixth or seventh interspace in the middle axillary line. Care should be taken that the needle is aseptic; that the skin at the point of puncture is well cleansed; and that the exhaust-pump is working well. All the liquid should not be withdrawn at one sitting. Often the withdrawal of a portion of it will result in the natural absorption of the quantity which is allowed to remain in the chest, and the small quantity remaining helps to prevent adhesions.

If severe cough develops during the aspiration the procedure should be stopped at once.

The ordinary bevelled needle commonly used for aspiration possesses the disadvantage that it has a cutting edge, which may wound the visceral layer of the pleura and cause pneumothorax. It is best to use a trocar and cannula with a side opening or by-pass. (See Fig. 133.) The rubber tube of the aspirator is attached to this by-pass. As soon as the chest-wall is punctured the stylet is withdrawn, leaving no sharp point to damage the lung. As the trocar cannot be entirely withdrawn, because a shoulder on its lower end engages in the shank, no air can enter. If the cannula becomes clogged the stylet can be pushed in and so dislodges the obstruction.

During this stage of effusion blisters have been largely used to aid absorption of the fluid which is present, but they are not of great service. When used they should be applied in the form known as flying blisters. (See Cantharides, Part II.) It is to be remembered that blisters are, as a rule, contraindicated in the case of children, because of the pain and irritation they produce.

The time at which an effusion is to be removed, as already stated, depends chiefly upon how greatly its presence interferes with respiration. Even if the needle shows it to be purulent there is no immediate need of removal, but if septic symptoms or pressure symptoms are urgent it must be removed. If the displacement of the heart is great we should first aspirate to relieve pressure and operate afterward.

The method of removal of pus depends on the state of the patient who, if still acutely ill or very weak, should not be subjected to incision and drainage, with or without excision of a rib, until fit to stand a radical measure of relief. Pus does not usually form during a frank croupous pleuropneumonia but after the acute illness is over. It is a sequence not a coincident complication.

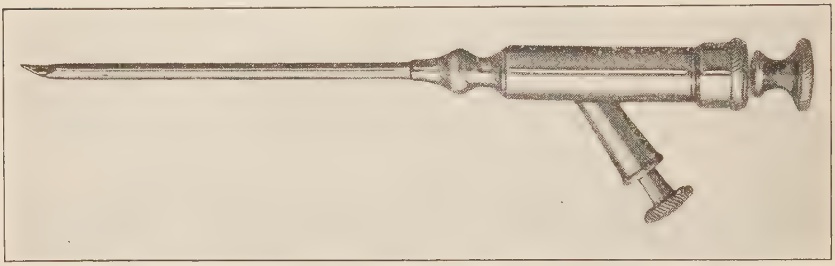

Fig. 133.—Trocar and cannula for tapping pleural cavity. As soon as the point passes through the chest-wall the trocar is withdrawn so that a shoulder near its point is brought in contact with a rim in the proximal end. Suction is then made through the lateral opening. If the cannula becomes plugged the obstruction can be overcome by pushing the trocar in again and then withdrawing it a second time. By the use of this instrument the danger of wounding or scratching the visceral pleura is avoided.

If the patient is a child much depends on its age and its general state. In infants, particularly if the pneumococcus is the cause, aspiration is usually the best measure. If the child is five or six years of age, repeated tappings may be tried but after ten to twelve years of age drainage is usually essential by the method given below or by incision and excision.

If the decision is to postpone radical measures because of the general state of the patient the following plan may be followed, particularly if a diagnostic puncture has revealed the presence of the streptococcus and a bacteriological examination should always be made first because a pneumococcic empyema usually has a better prognosis than when the pus is due to the streptococcus, and, second, because, when due to the pneumococcus, adhesions as a rule form early and when due to the streptococcus are prone to occur relatively later. After local anesthesia is induced a cannula 7 mm. in caliber is introduced in the seventh interspace posterior axillary line. Through this is passed a soft rubber 24-French catheter open at the end and with two lateral eyes. The cannula is withdrawn. A large sterile syringe is attached and the pus withdrawn. Before the syringe is removed, to empty it, clamp the catheter to prevent entrance of air. Replace the syringe, take off the clamp, and again withdraw pus and repeat until the cavity is empty. This interrupted method is preferable to rapid aspiration, as it does not cause rapid expansion of the lung. The cavity is now washed out by injecting Dakin's solution (see Antiseptics, Part III) to the extent of one-third the pus removed and leaving it *in situ*. The tube should be kept clamped to prevent the entrance of air and made fast to an adhesive strip on the chest wall so that it cannot slip out or in. The washing-out should be performed every two hours. When the fluid is repeatedly found to be sterile the injections are cut down to twice a day and when the pus cavity holds only about 20 cc. of the solution the tube is to be withdrawn so that air cannot enter, and the wound allowed to heal or closed. Always connect the syring with the tube before removing the clamp to suck out or inject.

The use of Dakin's solution, as pointed out in the article dealing with that fluid, is difficult in private practice although advantageous in hospitals. In its place chloramine-T, not dichloramine-T may be employed in 0.5 to 1 per cent watery solution. It is less toxic but does not so efficiently dissolve necrotic tissue, as does Dakin's solution but it is less irritating. When injected into the pleural cavity it need be changed but twice or thrice in twenty-four hours. Still another substitute more suitable for use by the general practitioner is called "Hychlorite." (See Antiseptics, Part III.) Excellent results have also followed the introduction of a solution of gentian violet in place of the chlorine solutions, the strength used beginning with 1 to 5000 and rapidly increasing up to 1 to 1000 or even more. Often only four to eight injections are needful. It is claimed that gentian violet is less irritating and singularly lacking in causing any disagreeable effects. Pleural injections sometimes cause convulsions.

While an empyema should not be actively treated during the presence of acute illness unless respiratory embarrassment is urgent it is to be recalled that it must not be so delayed as to permit adhesions to form as under these conditions this plan of treatment is futile.

Formerly the objection to the removal of pus by aspiration and tube drainage was the fact that in many cases the pus contained large masses of fibrin resembling large clots which not only prevented free drainage but prevented recovery. This difficulty is now put aside by the Dakin solution, which liquefies these masses. If the chlorinated fluid causes bleeding its use should be stopped for several days and sterile normal saline employed. The rule when empyema is present practically comes down to this: If the patient is *acutely* ill relieve pressure by tapping; if convalescent tap and aspirate and inject every two hours.

There is no advantage in tapping the most dependent part of the cavity. On the contrary, it renders it more difficult to keep the chlorinated fluid in the chest.

The roentgen-rays should be resorted to in order to determine the level of the fluid and the position of the tube in the chest, for if the tube is inserted with the idea that it will reach the lowest level it not infrequently is found to have doubled on itself so that it points upward, and so does not drain. By this means, too, the posture of the patient that results in best bringing about contact of the antiseptic fluid with the layers of the pleura is determined. This is a very important factor in producing a cure.

In order to cause proper expansion of the lung after convalescence is begun, chest exercises should be used (see Part III) and wash-bottles may be employed, as are shown in Fig. 134.

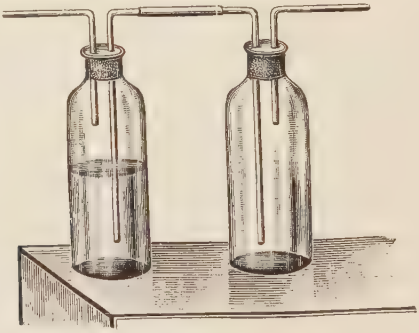

Fig. 134.—Arrangement of bottles for promoting lung expansion whereby blowing on the tube of the left-hand bottle passes the water into that of the right.

PLEURODYNIA.

This condition, being one of intercostal myalgia or neuralgia, should be treated according to the directions given under the headings of Neuralgia and Counterirritation.

PNEUMONIA.

Pneumonia is a term loosely applied to two different forms of disease—namely, that acute infectious process due to an infection by pneumococcus and called croupous pneumonia; and that form following, as a rule, some other disease which has exhausted the patient's strength and due in some cases to various forms of infection including the pneumococcus, namely bronchopneumonia. These two distinct diseases have been confused by the common term pneumonia, and yet are very different conditions as to their pathology and treatment.

It is to be recalled that about eighty strains of pneumococci have been isolated and a very important factor is the resistance of the individual and the virulence of the microörganism. Whittle of Addanbrook's Hospital, Cambridge, England, has well said that lobar pneumonia, bronchopneumonia, and empyema occurring in previously healthy persons are invariably caused by pneumococci of high virulence, measured by the effect on mice; whereas such conditions as terminal pneumonia and postoperative pneumonia, arising in subjects whose health is already impaired, are commonly caused either by pneumococci of feeble virulence, or by organisms such as Streptococcus salivarius, Micrococcus catarrhalis, Friedländer's bacillus, etc. The pneumococci of low virulence resemble these catarrhal organisms in other respects, for like them they are frequently the cause of chronic bronchitis, conjunctivitis, nasal catarrh, and other comparatively minor infections of the respiratory tract and of the membranes and sinuses adjoining it.

There is, however, one factor in treatment common to both classes, whether they occur in children or adults, namely, plenty of fresh air. In well-appointed hospitals croupous pneumonia is treated out of doors, as in an open shed or on the roof, with the result that the mortality is far less than in the best ventilated wards. A few hours of fresh air will often produce remarkable changes in the patient's condition. The open-air plan is indicated in the croupous type. When bronchopneumonia is present it is of questionable value, particularly in children or asthmatics.

Croupous Pneumonia.

The treatment can be divided into that devoted to the stage of onset, the stage of consolidation, and the stage of absorption of the exudate and convalescence; and it will be governed by the state of the patient's pulse, the sounds of his heart, and his general condition as to strength, as well as the degree of respiratory embarrassment when it is present. There can be no routine treatment of croupous pneumonia as each case must be a law unto itself, and there is no such thing as the depletant treatment to be advocated on the one hand, nor the stimulant treatment to be lauded on the other. (For Antipneumococcic Serum see article on Antitoxin, Part III.) Further than this, it must be remembered that as croupous pneumonia is an acute infectious disease the patient may die, not from pulmonary consolidation nor cardiac distention, but from the malignancy of the infection. One man with an entire lung consolidated may have slight evidences of general infection or toxemia; another with a small area of lung involved may be overwhelmed by toxemia within a few hours. For this and other reasons all cases of croupous pneumonia may be divided into three groups —those that are doomed to death by the malignancy of the infection, those that are but slightly ill by reason of mild infection, and those which are between these two extremes of severity and need careful medical aid to accomplish recovery. The first class die, do what we will, the second class get well almost without help, the third need all the help possible to survive. It is to this last class that our treatment must be chiefly directed.

It is of vital importance to remember that the patient does not need medicine simply because he has croupous pneumonia.

The fact must not be lost sight of that croupous pneumonia is often a terminal infection superimposed upon nephritis or some other malady. The primary disease must, therefore, be considered in all plans of treatment.

If severe pain in the chest is present, it is to be relieved by moderate doses of morphine or Dover's powder.

In the majority of cases the physician is called after consolidation has occurred, and he must be a watchman all the time and a therapeutist only when treatment is actually needed. Every patient who is suffering from pneumonia does not need active treatment. A certain number of cases get well without treatment, and do so sooner than if meddlesome therapeutics hinders them. The treatment usually necessary is to support the heart if it seems feeble or engorged, to keep the kidneys in a state of active secretion, combat tympanites and to see that constipation is relieved.

How anyone can see a hepatized lung and then think that those remnants of barbarism, cotton jackets and poultices on the chest, are going to do anything else than harm the patient I cannot understand. There is not a reader of this book who could tolerate a hot poultice all around his chest as long as it takes him to read this article. There would be a demand for more air because the poultice oppressed him, although he has two good lungs and a healthy heart. If a hepatized lung is the local lesion resulting from a general infection, why should we poultice the chest in pneumonia any more than we would paint the abdominal wall with nitrate of silver to treat the intestinal ulcers in typhoid fever?

In the treatment of the fever the physician should remember that it is not to be regarded as a dangerous symptom even if it rises to 105° F. and remains at this point for some hours, for in a febrile disease running a short course fever is not only harmless, but there is also reason to believe that when present to a moderate degree it is actually beneficial.[1] When the fever persists at a point above 105° F. it should be reduced by sponging with cool water, active friction being used at the same time. (See Cold in Part III.) There is absolutely no danger of the patient "taking cold," although this is generally doubted by the laity. If the fever has a tendency to be excessive or if the heart's action is rapid, an ice-bag may be placed over the heart. The cold plunge bath is always badly borne in croupous pneumonia. (See Cold, in Part III.)

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[1] See article on The Rôle of Fever in the Modification of Disease, in the Therapeutic Gazette for February, 1896.

The use of antipyretic drugs is not good practice. They tend to depress the heart, to relax the bloodvessels, and apparently render the patient more susceptible to his infection.

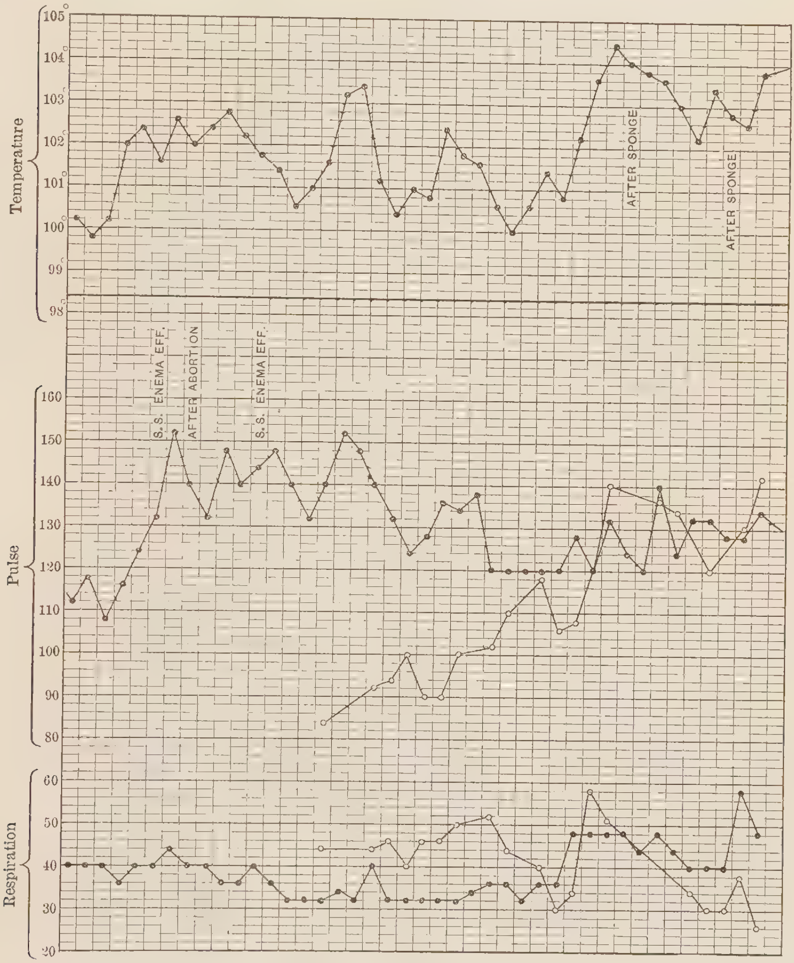

FIG. 135.—Chart of a case of pneumonia, complicated by abortion in the sixth month, showing the rise in systolic pressure produced by the free use of digitalis, from 82 millimeters to 140 millimeters. The lines o—o—o represent systolic and diastolic blood-pressure. In this case also the pulse was materially slowed which is unusual in the presence of fever.

For the support of the heart several circulatory stimulants may be employed. If the patient is an alcoholic and feeble, with lack of vitality and relaxation of his vessels, then alcohol in the form of a good whisky or brandy, given in water after food every three or four hours, in the dose of from ½ ounce to 1 ounce is useful. Sometimes more than this must be given, particularly if the patient has been accustomed to the use of this remedy. In most cases none is needed.

The writer usually gives 10 minims (0.65) of a physiologically tested tincture of digitalis every eight hours, with 10 minims (0.65) of the tincture of belladonna every four hours. (See Digitalis and Belladonna.) If necessary, both of these drugs may be given in larger dose, but usually these doses are sufficient. If the fever is very high, the digitalis will often have to be supplanted by alcoholic stimulants or strychnine for a few doses. The question as to whether the patient's pulse is of the proper strength is one of importance: very often the quiet pulse of a patient lying in bed will be taken by the anxious attendant as an evidence of true cardiac feebleness, when if the physician feels his own pulse he will be surprised to find it no stronger than that of his patient. A feeble apex beat, a feeble second sound at the second right costal cartilage (aortic valve), and an accentuated second sound at the third left costal cartilage (pulmonary valve) will reveal the fact that active stimulation is needed, for the weak apex beat and the soft second (aortic) sound show that the heart is feeble and the arterial walls relaxed, and this means a low arterial pressure. Further, the accentuated second sound on the left side indicates pulmonary congestion and a tendency to failure of the right side of the heart from obstruction to the flow of blood in the lungs.

One of the best means of determining upon the use of circulatory stimulants in pneumonia is the use of the sphygmomanometer. Gibson, in Edinburgh, and myself, in this country, have shown that danger arises when the pulse-rate per minute is equal to or above the systolic blood-pressure expressed in millimeters of Hg. Thus, if the pulse-rate be 90 and the pressure 140, all is well, but if the pulse-rate be 110 and the pressure 110, he is gravely ill and needs active cardiac and vascular stimulation. If the pressure in millimeters of mercury falls below the pulse-rate, the condition is usually desperate.

In many instances, however, the low pressure is not the result of weakness of the heart muscle but is present because the vessels are relaxed. In such a case the heart beats hard and fast in an effort to fill the vessels and becomes feeble more from fatigue than from toxemia. The heart does not need digitalis to make it work hard at this time, but its strength will be conserved if by the use of atropine, strychnine, caffeine or camphor the blood-pressure can be raised by restoring vascular tone. An estimation of the diastolic pressure and the pulse-pressure may guide the physician better than an estimation of the systolic pressure alone. (See Charts.)

As pointed out in the article on Digitalis in Part II, the heart uses an immense amount of oxygen, particularly if the patient is breathing rapidly and heavily, for such breathing is severe exercise,

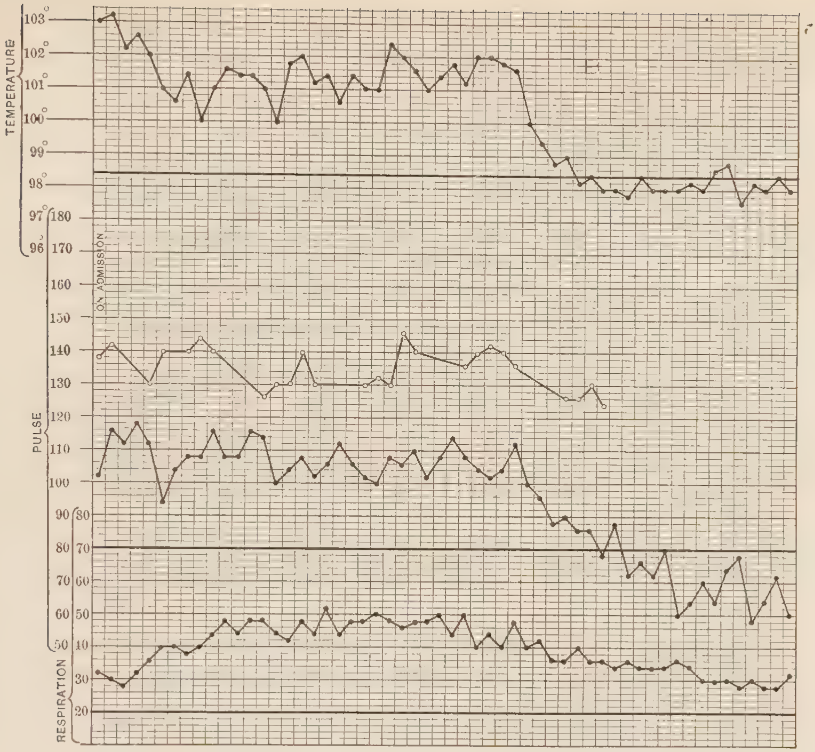

FIG. 136.—Case of croupous pneumonia. Blood-pressure normal and well separated from pulse rate. No treatment by stimulants needed. Third line from bottom of chart represents blood-pressure.

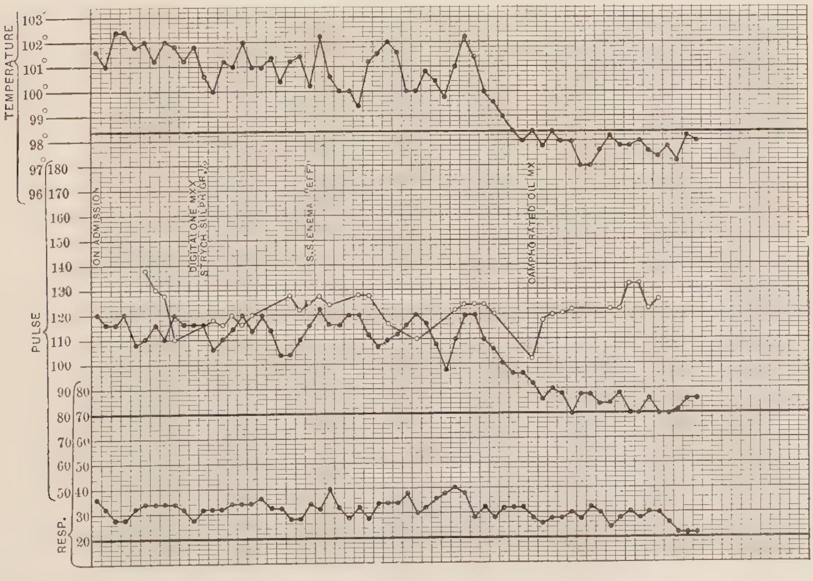

FIG. 137.—Case of croupous pneumonia in which the near approximation of blood-pressure and pulse rate required active stimulation, thereby saving life. With the occurrence of crisis the pulse rate and the blood-pressure assumed a normal relationship. Third line from bottom of chart represents blood-pressure.

as anyone will find who tries to breathe in this manner. Oxygen gas is needed to supply the heart with an excess of oxygen supply. It is of little use as commonly employed, for the patient gets too little. His lungs should be flooded with it by using in a mask with inlet and outlet valves if the heart is to be benefited, or by passing a well-oiled catheter through the nose after the mucous membrane has been procainized. The use of oxygen should not be delayed until cyanosis is marked but used at the earliest sign of its onset or before. The catheter can then be kept in place with an adhesive strip on the cheek. Oxygen should be given freely, at the first sign of impaired oxygenation of the blood for after cyanosis develops damage has often occurred in the lungs and elsewhere in the body. If freely and constantly used it will sometimes definitely diminish the pulse-rate when it is too rapid. Too often it is given for a short time and then stopped. If really needed it should be continued for hours. In many cases if there is venous turgescence venesection will induce a very slow flow of blood from the wound but if oxygen is given the blood will flow freely. (See Oxygen, Part II and Shock, Part IV.) In such patients, particularly if they are already poorly nourished, a very carefully prepared dextrose solution may be given intravenously. It should be warm, given slowly and not be over 5 per cent strength. (See Dextrose, Part II and Intravenous Injections, Part III.) More than 0.8 gram per kilo per hour will result in glucosuria. (See Oxygen, and Carbon Dioxide, Part II.)

If dyspnea and cyanosis are due to consolidation of a large area of lung oxygen freely given does great good. If cyanosis is due to a feeble right heart with pulmonary stasis it can do less good. If due to profound toxemia it can do little if any good.

Should the action of the heart become labored, the jugular veins distended and pulsating, and the radial pulse weak, while the face is cyanotic, then free venesection (Part III) is to be practised. It will sometimes save an apparently desperate case. Digitalis in the presence of this condition is not rapid enough in its effects.

Should collapse develop, strychnine (see Nux Vomica, Part II) should be given in full dose intramuscularly $\frac{1}{20}$ to $\frac{1}{10}$ grain (0.003–0.006), and with it, if the skin is moist or sweating, $\frac{1}{100}$ grain of atropine (0.0006), and both these drugs should be repeated in an hour if needed. At the same time it is well to give 1 dram (4.0) of aromatic spirit of ammonia every two hours in cold water or 1 dram (4.0) of spirit of ether in cold water every hour.

Should crisis come on at this time, active supportant treatment, such as that just described, may be needed. Many patients die in crisis for the want of active stimulation but others from over stimulation.

A point which I wish to emphasize is the error of writing prescriptions for a pneumonia patient and having them continued for days at a stretch. With the possible exception of belladonna, which is used to prevent vascular complications from suddenly arising, I have never seen any case of pneumonia which needed the same remedy, in the same dose, day after day. The skilled physician will fit his drug and his dose to the needs of his patient at each visit, for, like a captain of a ship, he cannot control the storm, but only handle his vessel. The captain of a ship who leaves the bridge with written orders to the helmsman at 10 o'clock in the morning and does not appear on deck again for twenty-four hours is courting disaster. The doctor who tells a nurse to use full doses of active remedies every few hours for the next twenty-four hours or for days is almost equally courting disaster. If the man needs stimulation he needs it actively in one or two doses. He rarely needs it again and again and again, unless he is in such a desperate state that the physician should stand by him to reach an accurate estimation of his condition from hour to hour. He may badly need help occasionally, but not all the time. A few good-sized doses of digitalis are often wise, but its persistent use in full dose is usually unwise. (See Nux Vomica, Part II.)

Nervous excitement with insomnia, if excessive, should be combated by small doses, $\frac{1}{8}$ to $\frac{1}{4}$ grain (0.008–0.015), of morphine, given in the early evening by hypodermic injection.

Urinary secretion if scanty is best maintained by the free use of water and some alkaline diuretic, such as citrate of potassium, and if necessary a little gin may be given to support the heart and aid in maintaining renal activity.

Expectorants in either type of pneumonia are never useful until the stage of resolution is well developed, if then. They cannot do good and they upset the stomach. There is nothing to spit up. Resolution takes place by the development of autolytic substances and we cannot hurry it. At best they only benefit the bronchitis if it is present.

Having detailed this treatment of the second stage, that for the third stage is to be considered.

It must be remembered that in most individuals the process of repair is carried out best if the efforts of Nature are not meddled with.

I wish to sound a note of warning against the use of iodides in cases of delayed resolution. The processes of Nature are best suited to the removal of the exudate in the vesicles of the lung. The iodides may hurry these unduly, and may in the general process cause an absorption of some old inflammatory mass which has walled off and rendered innocuous an old tuberculous deposit. In cases in which delayed resolution is present, and the physician is tempted to hurry it by the use of the iodide, he too often finds that the delay is not due to the remains of a frank pneumonia, but is the result of a terminal or coincident infection by other organisms, and the officious interference of the physician when Nature is endeavoring to produce good results may be followed by disaster. Not rarely so-called delayed resolution is really an empyema or an interlobar empyema.

First and foremost for the relief of any associated bronchitis stands the chloride of ammonium, a drug which acts most happily in aiding in the loosening of the cough and secretions. Its only disadvantage is its salty taste, which in many cases renders it disagreeable to the patient, while its irritant properties may disorder the action of the stomach, although if this organ is depressed and atonic this drug often improves its condition. This drug may be given in compressed tablets, or, what is far better, in such a mixture as here follows:

℞—Ammonii chloridi	ʒij (8.0)
Fluidextracti glycyrrhizæ	fʒij (8.0)
Aquæ destillatæ	f℥ij (90.0).—M.

S.—Teaspoonful (4.0) in water every four hours during the day.

If the cough be in excess of the expectoration—that is, if the cough often fails to bring up phlegm and is due to tickling or irritation—it may be relieved by the addition of a little morphine to this mixture, as follows:

℞—Morphinæ sulphatis	gr. j vel gr. ij (0.06–0.12)
Ammonii chloridi	ʒij (8.0)
Fluidextracti glycyrrhizæ	fʒiv (16.0)
Aquæ destillatæ	f℥vj (180.0).—M.

S.—Dessertspoonful (8.0) every four hours in water.

If much more morphine than this is used, it will tend to stop secretion.

When the chloride of ammonium fails to act favorably, the carbonate may be called into use for its local and circulatory action, and, in addition, the bromide of ammonium may be employed to allay the cough if morphine cannot be used. The following prescription is valuable:

℞—Ammonii chloridi	ʒj (4.0)
Ammonii bromidi	ʒj (4.0)
Ammonii carbonatis	ʒj (4.0)
Fluidextracti glycyrrhizæ	fʒiij (12.0)
Aquæ destillatæ	f℥vj (180.0).—M.

S.—Dessertspoonful (8.0) every four hours in water.

In other cases codeine may be given in the dose of ¼ grain (0.15) every eight hours to control excessive cough.

(For other remedies for this stage see Bronchitis.)

It must be borne in mind that the effect of expectorant drugs upon the pneumonic process itself is very slight, and that they are not to be given unless bronchial secretion is present in excess.

Nutritious broths, milk, and, if necessary, predigested foods, should be given with even greater regularity than medicine would be given, from the beginning to the end of the attack.

The problems in a given case are as follows:

1. Has the patient croupous pneumonia?
2. If so, what is his general state?
3. Are the heart, kidneys, and vessels primarily diseased?
4. Does he need any other treatment than rest in bed and good nursing?

5. If so, what does he, that individual, need?

6. Does he need stimulation, sedation, elimination?

7. If he needs stimulation, does he require it right along, or only at the moment? When we eat we don't eat all the time, day after day, but only when we need food.

8. As to all drugs follow Cromwell's motto, "Trust in God, but keep your powder dry." Don't give drugs all the time, but use remedies when needed fearlessly, and all the more advantageously because they have not been used before.

Catarrhal Pneumonia.

The main difference in the treatment of catarrhal pneumonia in distinction from the treatment of croupous pneumonia lies in the fact that first, last, and all the time the treatment is to be supportant in its character if any treatment other than rest in bed is resorted to. Catarrhal pneumonia usually arises out of a severe bronchitis or is superimposed upon some exhausting disease which has sapped the vitality. Toward its close expectorants are much more useful than in croupous pneumonia. Tuberculous infection should be suspected in all cases in which recovery is abnormally slow.

PRURITUS.

Itching of the skin or mucous membranes about the openings of the body is a very common state, and while it may be dependent upon local causes, such as hemorrhoids in the case of *pruritus ani*, it more commonly is due to some systemic condition, such as debility, diabetes, gout, or renal disease, or other similar causes. The treatment consists, first, in the removal of the cause, and, next, in the local treatment of the condition. There is generally no redness or eruption, except that due to scratching.

Internally, arsenic, quinine, bitter tonics, cod-liver oil, alkaline diuretics, or mineral waters are useful in debilitated cases, and an avoidance of condiments, such as mustard or pepper, is needful if the disease affects the orifice of the bowel, urethra or vagina.

The local treatment of pruritus consists in the use of lotions, salves, or ointments made up of various constituents, a number of which are capable of acting as local anesthetics. Very often bathing the parts with 1 dram of bicarbonate of sodium or of borax to 1 pint of cold water gives relief temporarily, or the following formulæ will be of service:

℞—Phenolis . . . . fʒj vel ʒij (4.0–8.0)
Aquæ destillatæ . . . . . . q. s. ad Oj (480 cc).—M.
S.—Apply as a lotion several times a day.

Or,

℞—Liquoris carbonis detergen[1] . . . . fʒij (8.0)
Aquæ destillatæ . . . . q. s. ad Oj (480 cc).—M.
S.—Apply as a lotion.

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[1] For method of preparing this liquid, see article on Eczema.

Or an ointment made as follows is serviceable:

℞—Phenolis	gtt. v. vel xx (0.3–1.3)
Adipis benzoinati	℥j (30.0)
Petrolati	ʒj (4.0).—M.

S.—Apply as an ointment.

In other cases an ointment containing the local anesthetic anesthone (para-amido-ethyl-benzoate) 10 per cent and adrenalin 1 to 20,000 is efficient. It is marketed in tubes under the name of Anesthone Cream.

Still another formula is as follows:

℞—Hydrargyri chloridi mitis	ʒj (4.0)
Phenolis	gr. xxx (2.0)
Picis liquidæ	fʒj (4.0)
Mentholis	gr. xv (1.0)
Zinci oxidi	ʒij (8.0)
Adipis lanæ hydrosi	℥ij (60.0).—M.

Ft. unguentum.
S.—Apply with gentle rubbing to the parts twice a day after cleansing them.

Dusting powders are more efficacious than lotions.

Cocaine may be painted over the parts, but it should rarely be used in ointment, as fats prevent its acting effectively. It should also be remembered that the anal and vaginal mucous membranes are so thick that strong solutions of cocaine are necessary to produce anesthesia, and that the effects of cocaine are only temporary. Cocaine is useless when applied to the skin. Where the itching is very obstinate the parts may be painted with a solution of nitrate of silver of the strength of 20 grains (1.3) to 1 ounce (30.0) of water, cocaine having been previously applied to relieve the pain of the application. (See also article on Cold.) In diabetic pruritus vulvæ, ordinary yeast, in the proportion of 1 tablespoonful to 1 quart of water, may be used on a compress to reduce the sugar which irritates the parts involved.

Allingham has used with advantage a piece of ivory shaped like a rubber nipple and provided with a circular shield. This is slipped into the bowel at night and serves to keep the surfaces apart.

In cases of general pruritus baths are often of great service. They may consist in plain hot-water baths or Turkish baths. In other instances, to each bath of 30 gallons may be added ¼ pound of bicarbonate of sodium, or 1 to 4 ounces (30.0–120.0) of borax may be used. When the skin is very irritated starch, 1 pound (480), or bran, 2 pounds (960), may be added to the bath. The bran should be put in a bag of gauze so that husks will not stop the drain pipe after the bath. Sometimes linseed-meal baths may be used. The meal is placed in hot water until the glutinous matter is set free, when it is added to the bath. One or 2 pounds (480 960) are used. In very persistent cases the patient may actually eat and sleep in the bath with advantage.

PUERPERAL DISEASES.

Puerperal Infection.—The treatment of puerperal infection has undergone great change within a few years. From being radical it has become most conservative, and many excellent obstetricians insist upon non-interference with the uterine cavity, except under very unusual circumstances, as interference only too often changes a local into a general infection. If interference is decided upon the plan later detailed is to be followed.

In more than 90 per cent of cases puerperal infection is a wound infection, the organisms being deposited in the cervix or the body of the uterus. The point of inoculation in the cervix is usually some abrasion or tear while in the body of the uterus the exposed vessels at the placental site are a favorite portal of entry. The organisms involved are in order of frequency the streptococcus, the colon bacillus and the staphylococcus.

The infection may remain more or less confined to its original site, being quickly surrounded by a barrier of leukocytic infiltration, or it may pass along the lymphatics (lymphangitis) or veins (phlebitis), draining the infected area, into the uterine wall (metritis), cellular tissue of the broad ligament (cellulitis), and even finally reach the ovary (acute interstitial oöphoritis or ovarian abscess), or the pelvic peritoneum (pelvic peritonitis). A general peritonitis may follow. In a majority of well-treated cases of puerperal infection the extension of the infection from the point of inoculation to surrounding or contiguous parts is limited by the resistance of the patient and the protecting barriers of leukocytic infiltration. The general symptoms in this form of infection are due to the absorption of the toxins from the infected area (toxemia) and not to the entrance of the bacteria into the blood stream (bacteriemia, pyemia). Such an invasion however may occur *pari passu* with the local infection or following it, or there may be an immediate blood stream infection with little evidence of localization of the infection at the area of inoculation. There may also be a form of toxemia due to the action of saprophytic organisms (sapremia) upon blood clots, placental tissue or decidua remaining within the cavity of the uterus.

It is obvious that no single plan of treatment meets all the requirements in puerperal infection.

Puerperal pelvic inflammatory disease is a wound infection. By the time the clinical evidences make their appearance the tissues have already been invaded by bacteria. Surgery can do nothing at this time, except in a few instances provide external drainage of the infected area; it cannot cope with the infectious germs embedded in the tissues. The resistance of the patient must be the main reliance, and that can be lowered by injudicious or meddlesome treatment or increased by careful nursing and by non-operative measures which help to check the spread of the disease.

As infection of the parturient tract may occur anywhere from the fundus of the uterus to the vulvar outlet the practitioner should carefully inspect all the lower parturient tract in order to detect any ulcerated surface covered by false membrane, which if overlooked might be the germinating area for a fatal infection. These unhealthy surfaces are best detected by the skeleton speculum of heavy wire. If an unhealthy, ulcerated wound is thus discovered, one should apply to it a solution of nitrate of silver 40 to 60 grains to the ounce (2.6–4.0 to 30). This application promotes an exfoliation of the unhealthy membrane and the appearance of healthy granulation tissue within a few days.

If there are indications of trouble in a perineal or a cervical tear which has been repaired, the sutures should be removed at once and the wound freely drained, so that there may be a minimum amount of absorption from the infected surfaces.

When the testimony of the medical attendant is clear that the entire fetus and placenta have been removed from the uterus, nothing should be done to disturb the interior of the uterus. Any intrauterine manipulation may do much harm by breaking down the protecting layer of leukocytes, which have been formed beneath the endometrium, and thus opening up new channels of invasion. In some cases the testimony of the attendant is doubtful and it is impossible to say whether or not there is necrotic material within the uterus, in which infectious organisms are swarming and from which toxins are being absorbed. Under such circumstances, if the os is unduly patulous, if the lochial discharge is free and of a putrid odor, if there are no indications of cellulitis or pelvic peritonitis, and if the pulse and temperature elevation are not excessive, the uterus may be gently explored with the finger and portions of placenta within easy reach removed with blunt placental forceps; following this the lower uterine segment and the cervix may be packed with gauze. The gauze pack promotes further dilatation of the cervix, and separation and expulsion of remaining fragments of placenta. The pack is removed at the end of twenty-four hours, when gentle exploration of the uterine interior may be repeated unless one can be quite sure that the remainder of the placental tissue has been expelled.

But if the uterus is fixed and surrounded by areas of induration in the pelvis, if there is any evidence of peritonitis, if the temperature and pulse are high, and the general condition bad, the uterine interior should be let alone. An exception to this is found in those cases in which the symptoms first mentioned are accompanied with profuse hemorrhage; in them the uterus should be packed with gauze.

All of these manipulations must be done with the most rigid aseptic technique. General anesthesia may be required, but should be avoided if possible. The use of an operating table, support of the legs by stirrups, good light, and plenty of assistance facilitate the manipulations and often render the use of general anesthesia unnecessary.

Intra-uterine douching and curetting are meddlesome and dangerous. Both have been the cause of immeasurable harm. No intra-uterine antisepsis can do any good and curetting only serves to drive an infection deeper into the uterus than it was before.

The patient should lie in the Fowler position so as to favor a localization of the inflammatory process to the pelvis. Ice-bags should be placed upon the lower abdomen. The bowels should be moved daily with an enema, simple or compound, but no cathartics should be administered. In bad cases 8 to 12 ounces of normal salt solution or 2 per cent, soda bicarbonate solution should be infused slowly into the rectum every three to six hours. Nothing but liquids in small quantities should be permitted by the mouth. Ergotin (Bonjean) in dose of 2 or 3 grains every three hours may be prescribed with advantage, as it induces firm contraction of the uterus, favors the expulsion of placental fragments, and possibly hinders absorption by diminishing the caliber of the veins and lymphatics in the uterine wall. After a few days, when the danger of a spreading peritonitis has passed, the amount of nourishment given may be increased, and a concentrated and nutritious diet given. Milk, broths, koumyss, eggs beaten up with milk or broths, predigested beef, or any of the highly concentrated, nourishing forms of food should be given up to the point of toleration. The exhibition of drugs by the mouth should be limited, so that the stomach can be kept in good condition for the digestion of food. Stimulants should be withheld until needed and then given in small dose, and gradually increased if more is required. Strychnine sulphate and alcohol in some form (whisky, brandy, and champagne) are the most useful. Digitalis, caffeine, and camphor may be held in reserve. The temperature, if excessive, may be controlled by the use of the cold sponge. If the patient complains of headache, an ice-cap should be applied to the head.

If the blood stream is infected, as shown by blood cultures (bacteriemia), the problem is more serious and complicated.

The following measures have been advocated to combat a bacteriemia: A specific serum; chemical disinfection of the blood; remedies to produce a hyperleukocytosis; transfusion of healthy blood, either in massive or in repeated small transfusions; and the hypodermic injection of non-specific proteins.

Antistreptococcic serum has been used more or less extensively ever since its first production by Marmorek—at first with much hope later with disappointment, but finally with considerable satisfaction. Experience has dictated the following rules for its employment: It must be used early; while ordinarily the report of the blood culture is awaited in fulminating cases. Serum may be given at the time the first blood culture is made.

Before the serum is administered the reaction of the patient should be tested by an injection of the serum (♏i) intradermally. The formation of an urticarial wheal with an areola of redness of varying width, contraindicates the use of serum until the patient has been desensitized by the repeated injections of small amounts.

The serum should have been recently prepared; the dosage should be large, at least 50 cc. twice daily. It should be given intravenously and should be administered at short intervals until its efficacy is tested; the standard rule is 100 cc. daily for four days and then no more. There is grave danger of anaphylaxis if a considerable interval is allowed to elapse, and then another dose, even a very small amount, is given. The judgment on this treatment may be summed up as follows: It is more often than not unavailing; it is helpful in one-quarter to one-third of the cases, and occasionally in the most desperate cases its effects are marvelous and immediate. It is certainly worth a trial.

Many substances have been injected into the blood for the purpose of destroying bacteria in the blood stream. Of these, mercurochrome, metaphen, anilin-gentian violet and neutral acriflavine are the ones most commonly employed. Neoarsphenamine (6 decigrams dissolved in 20 cc. of sterile distilled water, repeated in three days) intravenously has been successfully employed in the treatment of streptococcus blood stream infections. While there is no proof that this drug which is inimical to the parasite of lues (animal kingdom) has a destructive effect upon bacteria (vegetable kingdom) it is preferred by some to any of the other intravenous chemicals. Perhaps they all act by some secondary effect as yet ill-defined spoken of as "colloidal shock." For Gram-positive organisms (streptococcus, pneumococcus and staphylococcus) the choice lies between mercurochrome and metaphen or anilin-gentian violet. For Gram-negative organisms (rare in blood-stream infections) neutral acriflavine is to be preferred. Metaphen is preferable to mercurochrome in patients with unhealthy kidneys. In recent years the disinfection of the blood stream by the injection of mercurochrome-220, as first demonstrated by Piper, has been repeatedly done in selected cases with a fair proportion of good results. That this method is of value is not incontrovertible, and an observation of the method over a period of some three years has not convinced authorities that it is a valuable addition to our means of combating bacteriemia. (See Mercurochrome and Metaphen, Part II.) Nevertheless in desperate cases it is bound to be one of the plans of treatment for consideration and sometimes it will be of value. One must be careful that the dose is not too large.

The drug resorted to must be prepared just before it is to be used, as old solutions are of no value. The arm is prepared as for a blood culture, by scrubbing with green soap and sterile water and then painting with iodine and washing off the excess of iodine with alcohol. The drug is injected with a Luer syringe fitted with a fine needle, into the median basilic or the median brachialic, at a temperature of 100° F. The injection should be made slowly, and care must be exercised to inject the drug directly into the vein, as it is quite irritating and painful if it escapes into the surrounding tissue.

The reaction to be expected in a favorable type of case, following the intravenous injection of mercurochrome, is as follows: Within an hour the patient becomes somewhat nauseated and vomits; the vomitus is stained with the drug. Within two hours a violent chill for twenty to twenty-five minutes occurs. This usually is followed by a rise of temperature to about 105° F., followed by a gradual fall to normal or slightly below normal within twenty-four hours. Within six hours after the injection of the drug marked diarrhea occurs; this may continue for as long as twenty-four to forty-eight hours, during which there may be as many as twenty bowel movements.

The excretion of urine following the injection of the drug is scant and stained with the drug; chemical examination shows a heavy trace of albumin, but unless the kidneys have been deleteriously affected by the drug there are no casts present. Even in successful cases, in which the reaction to the drug has been quite favorable, the temperature may remain normal or slightly below normal for forty-eight to seventy-two hours, and then gradually rise, indicating that the blood stream has not been permanently sterilized.

The symptoms are treated symptomatically. At the time the chill begins extra blankets and hot-water bottles are placed around the patient. A special antidiarrhea mixture is given by Hirst consisting of:

℞.—Tincturæ opii deodorati		fʒij	(8.0)
Tincturæ belladonnæ		fʒij	(8.0)
Bismuthi subcarbonatis		fʒj	(4.0)
Mucilaginis acaciæ Aquæ cinnamomi	āā q. s. ad	f℥iii	(90.0)

Shake well before each dose.

Of this mixture 1 dram is given each hour for three doses following the injection of the mercurochrome solution, and after this 1 dram is given following each bowel movement until the diarrhea is checked.

For the decrease in the quantity of urine forced liquids are usually all that is required. Anuria rarely occurs. When it does occur it shows that some form of kidney disease, which is of course a contraindication to the use of the drug, has been overlooked.

Subsequent injections of mercurochrome may be required, and given safely in somewhat larger dose than the initial one, provided the diarrhea has been entirely checked and the urine is free from all trace of the drug, normal in quantity and without albumin or casts.

Metaphen and anilin-gentian violet (see Part II) are given in the same way and according to the same general rules. Metaphen has no reaction; the reaction of anilin-gentian violet is less violent than that of mercurochrome but it is probably also less efficient.

Nuclein is the most available substance for producing a hyperleukocytosis and, therefore, a better producer of phagocytosis.

A single massive transfusion, or repeated transfusions of small quantities of healthy blood have been advocated in the treatment of bacteriemia. It is of particular value in the type of sepsis associated with extensive disintegration of the red corpuscles and a high grade of anemia and hemoglobinemia; in such cases a single transfusion is invaluable. But transfusion is probably a considerable help in all cases, for there is almost always without it an increasing anemia and its effect as a foreign protein may be of the greatest value. Repeated small (350 to 500 cc.) transfusions are usually preferable to single larger (500 to 1000 cc.) ones.

Finally the use of vaccines and of non-specific proteins must be considered; both may be reserved for the later stages of the disease. One should always prepare a vaccine in cases of blood-stream infection from the first cultures taken; this requires at least four to five days. Although it may not be necessary or advisable to add this form of treatment to the others, one does wisely to prepare for it. About 25,000,000 bacteria should be given at the first dose; if this produces no reaction a larger dose is given the next time and so on increasing the strength of the injection up to 500,000,000 every third or fourth day. Some startling results have been reported from the intramuscular injection of sterilized skimmed milk (foreign-protein), beginning with 3 cc. and increasing to 10 cc. at intervals of two days. Exudates in the peritoneal cavity up to the umbilicus, associated with symptoms of virulent infection have entirely disappeared with this treatment. (See Aolan under Protein Therapy.)

With such plans of treatment about three-fourths of the cases of general septic infection after labor recover. Sometimes the patient is so overwhelmed with toxines that there is no response to any form of treatment. Occasionally general septic peritonitis develops rapidly and to an extensive degree. The question of opening and draining the peritoneal cavity then presents itself. While a post-vaginal or a suprapubic incision and drainage may appear to and actually do at times save life, in a majority of instances such a plan is useless and may hasten death. It should not be undertaken except the diagnosis is unmistakable. If done there should be no flushing of the abdominal cavity; free pus should be evacuated and ample drainage provided as quickly and with as little disturbance as possible.

Aside from this, operation in puerperal pelvic inflammatory disease should be limited to the uterine exploration already described during the acute stage and to the evacuation of collections of pus which become manifest at a later date. When in the course of puerperal pelvic inflammatory disease a mass forms on one side of or behind the uterus which softens or "points" in Douglas' pouch, and the daily marked remissions of temperature and the leukocyte count indicate an abscess, posterior vaginal incision and drainage should be made. Likewise collections of pus in the cellular tissue of the broad ligaments which "point" upon the surface of the lower abdomen above Poupart's ligament should be evacuated. Otherwise the pelvis should be let alone; after the temperature has returned to normal or nearly so and the disease is plainly under control, when the uterus is still enlarged (subinvolution), or there are masses on either side or back of it (cellular, adnexal, or peritoneal exudates), resolution may be hastened by hot douches. Operation to correct permanent residua of inflammation, subinvolution, retroversion, adherent or enlarged adnexa is not often required; if so, it should be postponed as long as practicable, weeks or months, until all of the acute symptoms have subsided.

Cystitis.—The most common point of infection outside the parturient tract after labor is some portion of the urinary apparatus, usually the bladder. Parturition necessarily diminishes the vitality of the vesical mucous membrane by the pressure and stretching to which it is subjected. After labor, therefore, it is not in a condition to resist the attacks of microörganisms, should these in any way gain access to the vesical cavity. Most commonly microbes are introduced into the bladder by a catheter. This, however, is not the only way, as it has been demonstrated that they can wander from the vaginal canal through the urethra into the bladder. Once arrived within the bladder, the microbes attack the depressed bladder cells, and may invade the vesical mucous membrane. This is manifested by the usual symptoms of septic cystitis—fever, pus in the urine, pain on pressure over the hypogastrium, and painful, frequent micturition. The duration of these symptoms is, as a rule, not very long. The fever subsides and the symptoms of cystitis disappear. After an interval of some days, however, there may be again a sharp outbreak of fever, with pain in the region of the kidneys, the reappearance of pus, or at least of numerous bacteria, in the urine, and a moderate leukocytosis. This often indicates a septic infection of the pelves of the kidneys and shows that the microörganisms have migrated along the ureters. During their migration their presence has not been manifested by any symptoms.

The practitioner, bearing in mind the possible serious consequences of septic cystitis after labor, should always see that any catheterization of the bladder is skilfully done so as to avoid traumatism and that every aseptic precaution is taken so as to prevent the introduction into the bladder of septic organisms. If unfortunately it nevertheless occurs, prompt treatment may avoid a further extension of the trouble.

In the first hours of the acute stage the use of heat over the bladder, the exhibition of refrigerant diuretics and the taking of large amounts of water will be sufficient; later if the painful symptoms continue gentle lavage of the bladder with warm normal salt solution followed by the instillation of a 20 per cent solution of one of the colloidal silver preparation will usually be successful. In the stubborn cases cystoscopic examination often shows the residuum of inflammation more or less confined to the trigonum and posterior urethra; then local application of silver 5 to 10 per cent may be employed. In the worst cases of bladder infection the mucous lining sloughs, peritonitis develops, and the patient dies before the disease has time to infect the kidneys.

Pyelitis.—As a rule, two causes are responsible for the occurrence of pyelitis: (1) An obstruction to or a stasis of the urinary outflow; and (2) an infection, De Lee asserts that 15 per cent of pregnant women have bacteriuria, this fact, together with the pressure of the enlarged uterus and the distortion of the ureters incident to the normally situated or displaced pregnant or puerperal uterus, furnishes the reason for the comparative frequency with which the condition appears in pregnant and puerperal women.

The infecting organism is usually the colon bacillus, but others, such as the tubercle bacillus, the Bacillus proteus, the Staphylococcus albus and aureus, the Bacillus typhosus, the gonococcus, the streptococcus, etc., have been reported. The organisms reach the pelvis of the kidney and ureter through the kidney tubules, being excreted through the kidney (bacteriuria), through the blood stream, or by way of the lymph channels, from neighboring structures (appendix, colon), and by ascending from the bladder either along the mucosa, as was previously believed, or by floating from a lower to a higher level in a collection of stagnant urine in an obstructed ureter, or through the periureteral lymphatics to the subpelvic areolar tissue that surrounds the bloodvessels of the kidney as they enter the pelvis.

Cabot and Crabtree found that the colon bacillus and the typhoid bacillus produce a different set of lesions in the kidney than do the streptococcus, staphylococcus, etc.

The colon-typhoid group causes acute pyelitis, acute pyelonephritis, chronic pyelonephritis, and pyonephrosis, whereas the coccus group causes perinephritic abscess, capsular abscess, capsulitis, cortical abscess, septic infarct, and diffuse suppuration. A mixed infection will show lesions characteristic of both groups.

Pyeloureteritis may also follow septic catheterization. The right kidney is more frequently involved than the left.

Although symptoms of acute cystitis mild or severe may precede the onset as already described, acute pyelitis may present itself unheralded with chill, fever, and pain along the course of the ureter and in the back. Vesical tenesmus, pain on urination, and a diminution of the urinary output may also then appear. The temperature often reaches 104° and 105° F., the rise usually being preceded by a prolonged and exhausting chill. The kidney on the affected side is markedly tender, and enlargement may be perceptible. Examination of the urine shows the presence of large numbers of pus cells, epithelial cells, and albumin. The ureter can sometimes be palpated through the vagina as an enlarged and tender cord.

In the course of several hours or days the subjective symptoms may abate; the temperature declines, the pain subsides, the urine is voided in larger quantities, and contains an increased amount of pus and albumin. All may then go well for as long as seventy-two hours, when the symptoms may suddenly reappear.

The attacks follow one another at different intervals and with varying intensity. In the milder cases prostration may not be marked, but in the severer ones the patient becomes emaciated, and the face assumes a hectic appearance. At first, at least, but one kidney, and that the right is usually involved, but after several days or a week there may be pain along the opposite ureter and indications of an extension of the inflammatory process to the kidney structure.

Acute pyelitis may yield rapidly to treatment, or it may prove exceedingly stubborn and resistant to all methods of treatment. The prognosis in general is favorable, *i. e.*, recovery usually occurs in from two to eight weeks.

The bowels should be kept open. Vegetable soups, milk in any form, and buttermilk may be taken. Water should be drunk freely. Solids and meat broths are to be prohibited. In the early stage the urine should be rendered alkaline by the administration of sodium citrate or of sodium bicarbonate, grains 30 every three hours. Later methanamine grains 10 and acid sodium phosphate grains 10 every six hours may be substituted. A change in reaction of the urine suddenly produced is said to retard bacterial growth.

If this treatment does not alleviate the symptoms, the ureter of the affected side should be catheterized and the ureter and kidney pelvis irrigated with boric acid or normal salt solution, followed by a 10 to 20 per cent solution of colloidal silver. This has two objects: (1) To relieve obstruction of the ureter and drain accumulated urine and pus, and (2) to destroy or weaken the infecting organisms. It may require repetition, or one thorough irrigation may be sufficient to mark the beginning of an improvement which is gradually followed by complete disappearance of the symptoms. Hunner insists upon thorough dilatation of the ureter at the obstructed point if that can be demonstrated and Aufhammer has treated these cases successfully by continous drainage with a permanent ureteral catheter.

Although the use of vaccine in the treatment of chronic pyelitis has not been encouraging, so far as can be judged from the literature, good results unquestionably follow in some cases; it may be used either alone or in conjunction with other treatment. At the time of the first ureteral catheterization a culture should be taken of the urine and a vaccine made therefrom; autogenous vaccines are preferable to stock vaccine. A portion of the urine obtained at the initial or immediately following the initial ureteral catheterization in cases of chronic pyelitis should be used for the inoculation of the guinea-pigs in order to exclude tuberculosis. In the majority of cases even the symptoms of pyelitis disappear after a time, and the patient makes a good recovery; but in a certain proportion there is a systemic infection from the kidneys. There may be extensive suppuration of the kidneys and surrounding tissue, with fatal results in exceptional cases or the symptoms of general systemic infection become so grave as for a long time to threaten the patient's life.

Proctitis.—Perhaps the most uncommon point of septic infection after labor is the rectum. Hirst has, however, seen one fatal case of this sort—from the use, no doubt, of a dirty syringe nozzle in the hands of a careless nurse. Septic proctitis is treated by boracic acid solution irrigations and iodoform (5 grains) suppositories.

Mastitis.—Next in frequency to the parturient tract and the urinary system, as a region prone to infection after labor, comes the breasts. Infection of the nipples, and a consequent mammary inflammation or suppuration, is one of the most troublesome minor complications that the obstetrician is called upon to treat. By careful preparation of the nipple during the last month of pregnancy, by extreme care to secure perfect cleanliness during the period of lactation and by supporting it with a mammary binder, infection of the breast can almost surely be avoided.

During the later months of pregnancy the nipples should be bathed twice daily with a solution of borax and equal parts of alcohol and water. They should not be washed with soap but cleansed when necessary with absorbent cotton and cold cream. Before and after nursing the nipples should be bathed with a solution of boric acid and between nursings they should be protected with squares of lint covered with sterile vaseline. Once every day they should be cleansed with the borax, alcohol and water solution and at the first indication of soreness or fissure, they should be painted with compound tincture of benzoin, covered with vaseline and protected between nursings with lead nipple shields, until completely healed. The infant's mouth should not be allowed to come in contact with the abraded or fissured surface, a nursing shield of glass and rubber or one made entirely of rubber like the "infantibus" should be used. In this way inflammation of the breasts may usually be avoided. If it occurs, the first effort should be to limit its extent and degree, and to prevent, if possible, suppuration. The best means to accomplish this end are found in depletion of the blood supply of the mammary glands by an active saline purge, compression of the gland substance, and support of the breasts with a suitable mammary binder.

To these should be added in the acute stage of inflammation, fomentations of very hot water, or a saturated solution of magnesium sulphate. Heat may be more continuously and conveniently employed by the application of a thick layer of antiphlogistine, covered with cotton and supported with a well-fitting firm mammary binder which compresses the entire breast uniformly and does not flatten the overhanging part of it against the chest. Hot-water bottles or a hot electric pad may be applied over the breast binder and the application renewed three or four times a day. The periodic complete emptying of the breast is continued by the nursing of the infant at regular intervals. The breast pump should be avoided if possible, but if the infant cannot empty the breasts sufficiently, the electric breast pump or nipple stroking may be used with great gentleness and all aseptic precautions; ordinary massage of the breasts should be prohibited. Unless the infection has been of a virulent nature and the amount of infective material large, this plan of treatment allays the inflammation and prevents suppuration. When suppuration occurs, the abscess should be opened and drained without delay.

The *other infectious fevers* of the puerperal state include the infectious diseases which might affect any adult female, and their treatment differs in no respect during the puerperium from that adopted under other circumstances unless there should be local complications.

Non-infectious Diseases of the Puerperium.

Superinvolution, an exaggeration of that process by which the uterus is reduced to its normal size after labor is rare; one rarely sees such a condition except in women who have nursed their baby much beyond the usual period of lactation. It manifests itself, as a rule, only after the puerperal state is completed, and therefore its treatment need not be considered.

Subinvolution, an arrested or retarded return of the uterus to its normal condition and dimensions after labor, is one of the commonest complications with which the obstetrician has to deal in the management of the puerperium. The cause of subinvolution is always a local one. General conditions, as acute fevers, have no influence whatever upon the process of involution unless they are accompanied by some local complication.

There are several causes of subinvolution. The normal involution may be prevented by anything which brings an excessive amount of blood to the uterine body, as, for instance, the retention within the uterus of small portions of the decidual or placental tissues. More often it is associated with the congestion incident to displacement; the latter may be the result of habitual constipation, too early resumption of activity on the part of the patient, adhesions or adnexal lesions. Small myomata in the uterine wall also are some times to blame.

In the treatment of subinvolution one must at once remove any decidual or placental remains which are known to exist. When their presence is reasonably doubtful the replacement of the uterus may be attempted and if it can be put into good position, it should be held there with a pessary. If this appears impracticable without the exercise of undue force or if the presence of adnexal inflammatory lesions is suspected then prolonged hot douches (one hour) once or twice a day should be employed. When there are no complicating adnexal lesions the treatment with heat may be supplemented by the regular use of the knee-chest and of the Sims' position.

Certain drugs are of benefit. Pituitrin or aseptic ergot hypodermically, posterior pituitary substance, grain $\frac{1}{10}$ or ergotine (Bonjeans), grain 3, may be employed. (See Pitocin under Pituitrin.)

In cases of heart disease, in which the blood current is sluggish and dammed back into the large veins of the trunk, digitalis is one of the most effective remedies; it may be combined with ergotine in the form of the powdered extract of digitalis, grain $\frac{1}{4}$, and given four times a day.

If myomata are present the treatment with hot douches may be instituted at first; but if the symptoms continue surgical or other intervention may be required.

Lacerations.—Every labor results in some *injury of the maternal structures.* Usually they are slight in degree, manifesting no symptoms and healing spontaneously. Occasionally the injury results in a fistula of the vagina or cervix communicating with the bladder or the rectum or in deep granulating wounds in the vagina, or in ulcerated sores.

In the case of a fistula a cure can sometimes be effected without operative interference by touching up the edges of the fistulous tract with a strong solution of silver nitrate (50 per cent) or nitric acid, in order to excite an out-growth of granulation tissue in the hope that it may plug the opening. In deep tears which have not been primarily united, the application of a solution of nitrate of silver (10 per cent), will hasten a cure and prevent infection of the wounded surface. If ulceration occurs, the ulcerated spots are to be carefully watched and treated in the same manner. All the injuries of the birth canal when practicable should be repaired by primary, intermediate, or secondary operation.

Repeated hemorrhages from the birth canal after labor depend upon a number of well-known causes, which must be sought out and corrected before the bleeding will cease. Most frequently the cause of a hemorrhage will be found in retained placental fragments, which must be removed. Hemorrhage also is one of the most frequent symptoms of subinvolution and may require the treatment already described for it.

Of all forms of bleeding, that which occurs directly after labor, known as *postpartum hemorrhage,* is the most frequent, the most alarming and dangerous in its manifestations and consequences.

The two most frequent causes of serious and immediate postpartum hemorrhage are: (1) The inertia uteri with or without the retention of portions of the placenta that follows a faulty management of the third stage of labor, and (2) deep cervical tears. For this reason if for no other the obstetrician should avoid undue haste in the management of the third stage of labor, postponing the attempt to express the placenta until the fundus has increased in size and risen above the pelvic brim and until there are spontaneous uterine contractions. The same attitude may be taken relative to premature attempts at delivery of the fetus, that is, before the os has completely dilated by Nature or has been slowly and skilfully dilated by artificial means.

No one should attend a case of obstetrics without having in mind a clearly defined program to be put into immediate execution when called upon to deal with this frequent and dangerous complication. There are two indications to be met: (1) To control the hemorrhage, and (2) to treat the after-condition. The first indication is met by the following plan of treatment:

External stimulation of the uterus by kneading and rubbing through abdominal walls, as is practised in Crede's method of expressing the placenta.

If this fails carry the aseptic (gloved) hand into the uterus and remove any blood clots, pieces of placenta or membrane that may be found there, and manipulate the parts so that the internal surface of the uterine walls is irritated by the movements of the operator's fingers.

The most certain and effective treatment when the hemorrhage depends on uterine inertia and a lack of the normal contractions is to pack the uterine cavity with plain gauze or iodoform gauze. Too much time should not be wasted on other measures before resorting to the intra-uterine pack.

The physician should give a suitable preparation as "ergot aseptic" or pitocin or both, in full dose hypodermically.

If one suspects that the hemorrhage come from lacerations along the birth canal a cervical pack with circular disposition of the gauze around the cervix in the vaginal vault, plus a firm pack in the vagina may effectually control the oozing; if such is not the case, the parts should be completely exposed with a speculum in a good light and sutures of catgut at once introduced.

After the hemorrhage is controlled, stimulation with drugs hypodermically may be used, caffeine sodium benzoate, strychnine, digitalis, pituitrin, adrenalin and atropine. Hypodermoclysis with salt solution or the intravenous administration of the latter may be indicated. It is well also to administer salt solution by the bowel or especially if the patient is anesthetized by elevating the patient and allowing a liter of hot salt solution to run into the large bowel. With the salt solution a pint of black coffee or 10 to 15 drops of adrenalin may be used; or 2 per cent bicarbonate of soda and 3 per cent glucose may be substituted if there is any complication with acidosis; this enteroclysis maintains the patient's temperature, relieves the shock, and by its irritation promotes contraction of the uterine muscle. The submammary or intravenous injection of normal salt solution is more efficient than the enteroclysis, but more difficult for the ordinary physician to administer. (See Hypodermoclysis, Part III.) As soon as reaction is well established a hypodermic of $\frac{1}{8}$ grain (0.008) of morphine should be given, in order to secure quiet and rest and to take advantage of the stimulant qualities which this drug undoubtedly possesses. Occasionally measures must be adopted to retain enough blood within the large vessels and the heart to prevent excessive cerebral anemia or cardiac failure. This is best done by bandaging the extremities from below upward, in order to secure as large a quantity of blood as possible within the vessels of the trunk and brain. Elevation of the lower extremities and the pelvis favors the same end.

In desperate cases blood transfusion should be done with all of the approved safeguards, viz.: typing the patient's blood and securing a suitable donor—either directly by the Unger method or indirectly after treating the donor's blood with sodium citrate. (See Transfusion, Part III.)

The *milk secretion* during the puerperal state presents abnormalities which call for treatment. One may have to deal with anomalies of quantity or quality. The most frequent anomaly of quantity in milk secretion is unfortunately one of deficiency. Insufficient milk supply depends on a number of causes. Perhaps the most frequent is a lack of development of the glandular tissue, and in this form of insufficient milk secretion no treatment can be of avail. Deficient sucking power of the infant and the failure to empty the breasts at each feeding is a frequent cause of deficient or failing lactation. When the lack of milk is due to some intercurrent affection in the puerperal state the treatment must be directed toward this complication before the milk supply can be reëstablished in normal quantity. It may be the consequence of hemorrhage or of diarrhea, or the result of an acute febrile attack during lactation, or of inflammation within the gland itself. Serious organic disease may also be a cause, and insufficient nourishment must be held accountable in some cases.

Profound emotions exert an extraordinary influence upon lactation in altering both the quantity and the quality of the milk. It has long been supposed that the return of menstruation has a disastrous influence upon milk secretion. The infant is usually upset for a few days, there is vomiting, colic and disordered stools; this, however, does not invariably occur. The return of normal menstruation without complications may have no disturbing influence whatever upon the quantity or quality of the woman's milk.

Electricity has been vaunted as a remedy for insufficient lactation. It may be applicable in cases of torpidity of the mammary gland or in those cases in which lactation has been suppressed after the birth of a first child, and in which the mammary gland, therefore, does not respond readily to the stimulus of subsequent births. This remedy will, however, often prove ineffective and disappointing.

The use of Bier's cups to produce local hyperemia is logical and has proved efficient.

Pituitrin has been shown to be a galactagogue in animals and possibly in women. It may be given by the mouth or hypodermically, and it has seemed to some observers to be efficient. As a rule forced feeding will be one's chief reliance, the patient taking all the nourishing food she can without overburdening her digestive powers and ruining her appetite.

Excessive milk secretion is often more apparent than real—*i. e.*, the milk is frequently of poor quality and not over abundant and yet it escapes more or less continuously from the breasts. The milk ducts are probably unusually large in such cases. Galactorrhea rarely may be stubborn or persistent, but usually it may be controlled with firm compression of the breasts, abruption of nursing, starvation or limited diet and free purgation. Among the other things recommended have been the application of belladonna ointment, and the administration of ergot, chloral, and antipyrine.

Quantitative and qualitative anomalies in the milk secretion most often depend upon an ill-regulated diet. A fatty diet with deficient fluids diminishes the quantity of milk; a vegetable diet diminishes the casein; and fat increases the sugar; a diet rich in meat especially if reinforced with alcoholic stimulants, increases the fat and casein but diminishes the sugar. If the mother's milk is evidently disagreeing with the nursing infant, a chemical analysis of it may be made, but one must remember that there may be much difference between the first and the last milk in a full breast; that the milk may change decidedly during twenty-four hours and that while some babies thrive on 4 per cent fat others do equally well on 2 per cent. One may usually do better by varying the mother's diet, increasing or diminishing the solids or the water according as the milk appears too dilute or too concentrated, too weak or too rich. The most common mistake in practice is to overfeed a nursing woman, especially with a milk diet, as the idea prevails extensively among the laity that cow's milk poured into the stomach appears again in the mammary gland. It is usually sufficient for a nursing woman to observe the ordinary diet which agrees with her under all circumstances, with the addition of a $\frac{1}{2}$ pint of milk sipped with each meal and not between meals. Occasionally a wineglassful of malt at the midday and evening meals is a useful addition to the diet, and in anemic patients the addition to the malt of 5 grains (0.3) of pyrophosphate of iron is an advantage. The Apt electric breast pump is of great value in the early days of nursing when the baby for some reason or another is a "poor sucker" and does not stimulate secretions by emptying the breast at each nursing.

There is found in every pregnant woman some alteration in the constitution of the blood, which consists, roughly speaking, of a diminution of the red blood corpuscles and of the albumin and the iron in the blood, with an increase in the white blood corpuscles and the serum. In some cases this change is much exaggerated, so that an intense degree of anemia appears in the puerperal state which, in its severity, simulates pernicious anemia or some fatal form of blood disease. The anemia of puerperal women, however, even in severe cases, usually yields to treatment. After the continued use of Blaud's pills the blood corpuscles sometimes rise from less than 3,000,000 to nearly 4,500,000, and the hemoglobin increases from 40 to 50 per cent in a few weeks. In some cases arsenic alone succeeds where iron fails completely. In severe anemias requiring active treatment the best plan is 3 to 6 vials daily of liver extract with the coincident administration of iron.

Eclampsia.

To treat eclampsia intelligently and successfully it is necessary to understand its etiology as fully as modern knowledge permits. Although the subject needs more light from future investigations, enough is now known to justify the following statement:

1. The cell activity of mother and fetus produces toxins which are poisonous to the whole organism unless they are voided or made harmless by the excretory organs.[1]
2. The organs in the child-bearing woman are often inadequate to produce antidotes to or to eliminate these toxins.
3. Consequently, poisons, of a nature not yet demonstrated, are stored up in the maternal blood until, by cumulative action, their presence is manifested in the eclamptic seizure and other symptoms.
4. The convulsions are probably the result of an acute cerebral anemia brought about by violent contraction of the arterioles. As a result of intense muscular action the circulation is interfered with, and blood is determined into non-muscular regions, as the brain, lungs, kidneys, etc., to such a degree that the congestion of these parts becomes dangerous, leading to apoplexy in the brain, edema in the lungs, and often a complete abrogation of renal function.

The toxins exert an effect upon the lobules of the liver like phosphorus or chloroform, causing degeneration of the cells. The indications for treatment in convulsive seizures of this nature are plain:

First, to eliminate the toxins from the blood as quickly and in as large quantities as possible. Second, to diminish nervous sensibility and lessen muscular power, in order to reduce the convulsions in vehemence, duration, and frequency. Third, if convulsions occur during labor, to save the infant without adding to the risk of the mother. Fourth, to guard the woman from injury during the attack.

The first indication is met by venesection, diaphoresis, and catharsis. By the first, one eliminates a certain quantity of poison along with the blood and relaxes the muscles. If there is sharp postpartum hemorrhage, or if the patient is from any cause weak and anemic, blood-letting is not called for. In the ordinary case, however, with full pulse, congested head, the veins standing out upon the neck and face, and a high blood-pressure, 160 systolic and over, venesection is an undoubted advantage.

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[1] Harold, C. Ernst, American System of Obstetrics, vol. ii, p. 431.

The volume of blood removed may be replaced with an equal quantity of 1 per cent soda bicarbonate solution if there is acetonuria or any other indication of acidosis. Titus of Pittsburgh and others believe that hypoglycemia is the basis for many cases of eclampsia and gives dextose intravenously (75 grams in from 100 to 500 cc. of sterile distilled water). While the median basilic of one or both arms is being opened some croton oil should be sent for, and 2 minims (0.1) mixed with sweet oil may be placed upon the tongue. As the stomach and intestines may add to the toxemia by absorption of their contents, the stomach should be washed out with the stomach-pump and the colon should be irrigated. If the stomach pump is used the laxative can best be administered through it, 2 ounces of castor oil with 2 minims croton oil added or 2 or 3 ounces of a saturated solution of Epsom salts directly introduced into the stomach.

Directions should at the same time be given to wring out 4 blankets in hot water; these are to be wrapped around the legs, trunk and arms, and well covered over with one or more dry blankets. A steam bath in a portable cabinet (99° F.), is more efficient if practicable. Whenever electric lights are available, an improvised cradle covered with blankets beneath which the lights are burned at a safe distance from the patient's body may answer all the purposes of an electric cabinet and promote free diaphoresis. A submammary injection of 1 pint of sterile water is a valuable aid in producing free diaphoresis. The sweating thus induced may be profuse. An ice-bag must be put to the head to prevent over-congestion of the brain.

The sweats and injection of fluid should alternate two hours apart, but the fluid after the first injection should be by the bowel, and instead of salt solution it is now an accepted practice to instil into the bowel, by the Murphy method, bicarbonate of sodium solution ℥j.–Oij, with 1 ounce of levulose, to combat the acidosis, which is usually present in eclampsia, for the same reason 500 to 1000 cc. of a 3 per cent freshly prepared solution of glucose may be given, the size of the dose and a repetition of the treatment being controlled by blood-pressure readings. In this way, directly and indirectly through the skin and bowels, one eliminates the cause of eclamptic convulsions as quickly and thoroughly as possible from the blood. The bowels may be acted upon by $\frac{1}{4}$ grain of elaterium rubbed up in butter, or by compound jalap powder and calomel, instead of the croton oil. If the patient cannot swallow, the stomach pump may be used, as already stated, to introduce castor oil into the stomach. Pilocarpine seemed at one time an ideal remedy to secure diaphoresis in eclamptic cases, but it has fallen into well-deserved disrepute. It much increases the danger of pulmonary edema, and is too profound a depressant. It is no longer employed by experienced obstetricians, except in post-partum eclampsia, when the hot baths do not result in a satisfactory sweat.

The second indication is best met by morphine in full doses, combined with chloral hydrate and sodium bromide. Stroganoff, who advocates the sedative treatment in eclampsia as most important, insists on absolute quiet. Avoidance of all physical and psychical irritation and the narcotization of the patient. He and his followers have secured a remarkably low mortality by this treatment. The morphine may be energized by a hypodermic injection of 2 cc. of a 50 per cent solution of magnesium sulphate, or by the intravenous injection of 20 cc. of a 10 per cent solution. (See Opium, Part II).

Anesthetics are of little use. Chloroform employed for any length of time produces the same hepatic degeneration as the toxins of eclampsia, and ether damages the kidneys and promotes acidosis. Nitrous oxide and oxygen is the safest form of anesthesia.

If convulsions come on during labor, the child should be rapidly extracted as soon as the os is well dilated, but not before, because efforts to dilate the os cause shock, increase the convulsions, and distract the physician's attention from the woman's most threatening danger. Moreover, the os usually dilates with rapidity during eclampsia.

In consequence of experiments showing the relationship between the parathyroids and tetany, parathyroid extract in 1-grain doses is a logical addition to the treatment and has been reported occasionally to be effective.

The high blood-pressure of eclampsia is recognized as one of its dangers; measures to reduce the systolic pressure should always be considered. The most effective are blood-letting, puncture of the membranes, sweating, veratrum viride (see Part II), and nitroglycerin. Lumbar puncture may be tried if the convulsions are excessively frequent and prolonged but its influence is doubtful.

The only injury to be feared during eclamptic attacks is wounds of the tongue from the teeth. They can be prevented by inserting between the teeth a brush-handle wrapped in a handkerchief or by drawing a towel into the mouth like a bit. Well-meaning but ignorant bystanders sometimes throw themselves upon an eclamptic patient to restrain her convulsions by force. This should be forbidden. Secretions should be swabbed out of the mouth by the aid of a mouth gag, because infectious pneumonitis by inspiration of saliva and blood is an occasional cause of death.

PYELITIS.

Pyelitis or infection of the pelvis of one or both kidneys is always to be considered as possible when fever is present without obvious cause. This is particularly true in young children. The urine should be obtained by catheter under aseptic precautions or at least after the external genitals have been carefully cleansed. If pus is present under the microscope it should be cultured to determine the type of infection and its reaction should be tested with litmus paper. If acid and the colon bacillus is present, as is the case in the great majority of children, copious water drinking should be practised and the urine made alkaline by the use of potassium citrate solution or by sodium bicarbonate the flat taste of which can be overcome by a little orange juice. If this treatment fails the use of colon vaccine is fairly certain to give good results, indeed this is about the only instance in which I resort to vaccines. The dose should usually be given every second day using a few drops of the suspension so as to avoid a sharp reaction although in some cases which are obstinate such an effect may be advisable two or three times. Some clinicians are content with so-called stock or commercial vaccine, others insist upon the use of autogenous vaccine. Another form of treatment if the urine is primarily alkaline is the use of methenamine, the acidity of the urine being maintained by the drinking of bitartrate of potassium in water in doses so adjusted as to keep the urine acid without irritating the stomach. It is worse than useless to give methenamine if the urine is alkaline since this drug only sets free its formaldehyde, that is exercises an antiseptic effect, in the presence of an acid urine. The dose of methenamine is practically speaking what the stomach will bear, usually a child of five years will take 5 or 6 grains three times a day if well diluted and given an hour after food. The treatment of the severe forms of pyelitis with active suppuration falls within the province of the genito-urinary surgeon rather than the general practitioner. (See Hexylresorcinol, Part II.)

When pyelitis is persistent and does not yield to the ordinary methods of treatment, one should suspect some narrowing of the ureter. Dilatation of the ureter and the relief of urinary stasis from the pelvis of the kidney is one of the most important features of treatment in many cases.

RETINITIS.

Retinitis, or inflammation of the retina, is commonly the result of constitutional diseases, for example, Bright's disease, diabetes, syphilis, etc., of altered states of the blood and bloodvessels, infections, toxins and traumatisms, or it may be due to the extension of a diseased process from an inflamed iris, ciliary body or choroid. The general remedies must be directed according to the cause, and the eyes must be protected from light, and all close work avoided. Very distinct retinal irritation may be caused by eye-strain, which is to be relieved by the prolonged use of atropine and dark glasses, and later suitable lenses for the correction of any existing error in refraction.

Retinal angiosclerosis is revealed to the ophthalmoscope as the result of primary, secondary and consecutive arteriosclerosis. Indeed, the retinal vessel changes—arteriovenous compression, perivasculitis, irregularity of the vessels, exudates and hemorrhages—are frequent and often appear as early indications of hypertension and general arteriosclerosis. The treatment concerns itself with regulation of the etiological factors. (See Blood-pressure, Nephritis, Gout, in Part IV.)

RHEUMATISM (ACUTE ARTICULAR).

No better example of the fact that therapeutics is in advance of pathology can be adduced than the disease known as acute rheumatism. The therapeutist cannot tell how he cures the condition designated by this name, simply because the pathologist cannot tell what the cause of the disease is. It would seem probable that the salicylates exercise a good effect by affecting a specific micro-organism or its educts. It must be remembered, however, that all cases of acute multiple arthritis are not articular rheumatism. In many cases they are due to the gonococcus, the pneumococcus, or other pathogenic germs, and in all such instances the salicylates are useless, except to reduce pain. It is claimed by some clinicians that cinchophen or neocinchophen is equally efficacious or even better than the salicylates as a curative or pain-relieving agent but this has not been my experience. To be efficacious 60 grains (4.0) a day must be used. (For caution see Cinchophen, Part II.)

The treatment of acute articular rheumatism is divided into that portion devoted to the cure of the disease process, and that directed to the relief of the pain and of the other and local manifestations of the disease.

A solution of bicarbonate of sodium, 20 grains to the ounce (1.3-30.0), may be applied to the joints involved, by means of lint wet with this solution, with diminution of the sense of heat or burning, or ice-cold compresses may be tried. In other cases relief may be obtained by applying hot cloths saturated with the so-called Fuller's lotion—namely, carbonate of sodium 6 drams (24.0), laudanum 10 ounces (300.0), glycerin 2 ounces (60.0), and water 9 ounces (270.0). Sometimes much benefit can be obtained by fixation of the joints by means of splints. Dressings kept wet with a saturated solution of magnesium sulphate are very useful.

A most valuable application to the inflamed joints of rheumatism, and the one the author has employed for many years to the exclusion of all others both during the acute stage and afterward when they remain swollen and enlarged, is:

℞—Ichthyolis . . . . ℥ij (60.0)
Adipis lanæ hydrosi . . . . ℥ij (60.0).—M.
S.—Smear thickly over the joint and apply on lint in addition.

In other cases the acute stages of the inflammation may be combated with advantage, particularly when there is gastric disorder, by the local application of salicylic acid made into an ointment with an animal fat, not vaseline or glycerin, as it is not absorbed when so mixed. According to Bouget, this treatment is best suited to blondes and young persons, as absorption is more rapid in this class of patients. The following salve may be prescribed:

℞—Acidi salicylici	ʒj (4.0)
Olei terebinthinæ	♏xxx (2.0)
Adipis lanæ hydrosi	℥j (30.0).—M.

High fever is to be controlled by the same measures as the high fever of any other disease—by cool sponging, or sponging with tepid water, and sometimes by the use of antipyretic drugs, the use of which is more justifiable in this case than in ordinary fevers in that they tend to relieve the pain.

Immediately on seeing the patient the physician should resort to salicylic acid or its salts. It is worthy of note that good results generally follow rapidly; that is, the salicylates give relief in from three to four days, or fail altogether. It is most important to remember that salicylic acid protects the cardiac valves and the entire endocardium from the ravages of the disease only by shortening the attack, and not by any direct influence; and in addition that this acid, by reason of the profuse sweats often produced by it and its tendency to cause cardiac depression, must be watched lest it act unfavorably on the general systemic state.

The proper use of salicylic acid is often misunderstood, and it fails to produce good results sometimes because of this fact. Whenever acute articular rheumatism appears the salicylic acid should be pushed in the same way that we use quinine on the advent of a malarial paroxysm—namely, in full dose.

It is useless to give salicylates in 5- or 10-grain (0.3-0.6) doses three times a day; they must be given in 20- to 30-grain (1.3-2.0) doses or more, morning, noon, and night, or oftener, or not at all. If the sweats are too severe or the stomach rebels, they may be stopped, but not decreased in amount unless for good reason. Further than this, if salicylic acid is used for three or four days in this way, and produces evidences of cinchonism, yet fails to alter materially the course or severity of the trouble, it should be withdrawn, as it will rarely if ever do any good after this time because the disease is due to an infection of the joints by some microörganisms upon which the salicylates have no influence and other therapy may be essential. (See Vaccine Therapy, Protein Therapy and Salicylic Acid, Acetylsalicylic Acid and Novaspirin.)

Lees also asserts that the salicylates often fail in acute rheumatism because the dose is not large enough. He advocates as much as 300 grains a day to a child, and insists that large doses of bicarbonate of sodium are necessary to prevent evil effects from these doses. The chief of these is "air hunger" or dyspnea. The author would be afraid to use such large amounts, but this view of Lees emphasizes the fact that the doses used are often too small.

In the author's experience the salicylate of strontium is a very useful substitute for the acid, as it is less apt to irritate the stomach.

Clinical experience seems to show that if sodium bicarbonate is given in full doses with the salicylates, better results are obtained than if the salicylate is used alone. The dose of the bicarbonate of sodium should be about 20 to 30 grains (1.3–2) three or four times a day. It is also thought that this mixture protects the heart, whereas the salicylate when given alone fails to do so.

Acetanilid does good by benumbing the sensibility of the patient to the excruciating pain consequent upon movement, and so putting aside the nervous wear and tear of sleeplessness and suffering. Further than this, it would seem probable that acetanilid possesses a direct antirheumatic influence. The author has found that acetanilid in such cases will often relieve the pain, and so permit a refreshing sleep, in doses of from 4 to 8 grains (0.25–0.5) three times a day, and that these amounts do not cause the excessive sweating which the necessarily large doses of salicylate sometimes produce sweats which leave the patient oftentimes almost dyspneic from very weakness. Whether this temporary relief produces such changes in the system as to permit of a better battle against the disease, or whether it actually counteracts the rheumatic poison, we do not know.

The following prescription, which is of additional value because the caffeine supports the heart and increases urinary secretion, may be employed:

℞—Acetanilidi	gr. xl (2.6)
Caffeinæ	gr. xx (1.3)
Camphoræ monobromatis	gr. xx (1.3).—M.

Fiat in capsulas *vel* pilulæ No. xx.
S.—One every three hours or three times a day.

Acetphenitidin is often very useful when used in rheumatism for the relief of pain, particularly if combined with phenyl salicylate (salol).

The other drugs used in acute rheumatism are numerous, but only a few of them deserve attention here.

A large number of drugs are used in subacute or chronic rheumatism. Of these the chief is the iodide of potassium, followed by the acetate, bicarbonate, and citrate of potassium. If the iodide is used, the following prescription is of service:

℞—Potassii iodidi	℥j (30.0)
Syrupi sarsaparillæ compositi	f℥vj (180.0).—M.

S.—Dessertspoonful (8.0) three times a day, after meals.

In other cases it is best, because of the disagreeable taste of the iodide, to give it in sugar-coated pill or in tablet form, but care should be taken that milk or water is taken at the same time to prevent gastric irritation.

Or, if preferred, 10 to 30 grains (1.3–2.0) of the bicarbonate of potassium may be taken every four or five hours in water flavored with cinnamon for the sake of the taste, or the citrate of potassium, which is more agreeable, may be taken in equal amount. If the case is very obstinate, sometimes a little colchicum added to the prescription given above may be useful, as follows:

℞—Potassii iodidi . . . . ℥j vel ℥ij (30.0–60.0)
Tincturæ colchici seminis . . . . f℥ss vel f℥j (15.0–30.0)
Syrupi sarsaparillæ compositi q. s. ad f℥vj vel f℥xij (180.0–360.0).—M.
S.—Dessertspoonful (8.0) three times a day, after meals.

In all cases of rheumatism the physician should look for septic foci in the tonsils, jaws or prostate gland.

The *local* remedies in the later stages of rheumatism are chiefly counterirritants and sedatives. Baking the joint, by means of a hot-air apparatus (see Heat, Part III), with gentle Swedish movements and massage, may be of great value in restoring the suppleness of the joint and in aiding in the absorption of the effusion. Sometimes the application of ichthyol and lanolin in equal parts, also rubbing this ointment into the tissues thoroughly, will aid in the absorption of inflammatory exudates.

In this connection we must not forget the great value of morphine in endocarditis, myocarditis, and pericarditis; for not only does this drug give relief from the pain, but it also diminishes the patient's anxiety, quiets his restlessness, and slows the pulse by this means and by direct action upon the circulatory system. This question of slowing the heart does not receive sufficient attention. When we consider that a difference of 10 beats a minute amounts to 600 beats per hour, and to nearly 15,000 beats a day, we can see how comparatively slight variations in pulse-rate may mean very great variations in the amount of work done by the heart in twenty-four hours. For the prevention or relief of endocarditis the application of a number of small blisters over the precordium seems to be a very valuable measure; or, in their place, 8 to 12 leeches may be placed over the heart and followed by the application of an ice-bag. (See article on Pericarditis.)

No drugs can serve to protect the heart so well as complete physical rest. Not only is this necessary during the attack, but for several weeks afterward; and if the patient gets up too soon, a latent, unsuspected valvulitis may gradually develop into a fatal lesion. The lame valve must be given time to recover before it is given more work to do. This is perhaps the most important therapeutic fact in regard to the therapy of this disease. Furthermore a large proportion of patients not only develop valvulitis but carditis and both of these states may last long after all joint signs, and even valvular signs, disappear. Drugs which have a cardiac effect, unless urgently needed, should be avoided because many electrocardiographic studies have revealed that all sorts of disturbance in muscle action occur from disturbed rhythms to partial and complete block, and it is interesting to note that these changes may be not permanent but change from hour to hour.

RHEUMATISM (CHRONIC ARTICULAR).

Chronic rheumatism is one of the most obstinate diseases with which we have to deal. In some cases the acute form just considered merges slowly into the chronic form, or, in other instances, the disease develops gradually, increasing, it may be, by exacerbations or by gradual progression. In a large proportion of cases it is usually a low grade septic arthritis, in which the joints suffer from a single or multiple infection, and all sources of infections, as in the jaws, tonsils or elsewhere, should be sought for. In other cases the cause is a rheumatic or gouty diathesis. (See Vaccine Therapy and Protein Therapy.)

The treatment of chronic rheumatism is somewhat different from that of the more acute form, and approaches that of gout in some of its therapeutic indications. In other words, the salicylates are not so useful in these cases as are the iodides and colchicum, so that in the majority of instances the prescription of iodide, sarsaparilla, and colchicum given in the article on Acute Rheumatism is indicated. When anemia or weakness is present, cod-liver oil is often of great service, and it is worthy of note that this useful nutritive remedy was first brought into therapeutics by the fishwives of Holland, who found it useful in the attacks of rheumatism to which their husbands were subjected through exposure.

When the oil is thoroughly rubbed into chronically inflamed joints it is almost as useful as when taken internally.

Full doses of syrup of the iodide of iron are often efficient. In other cases 15 grains (1.0) of iodide of sodium given intravenously once a day is of notable service.

A very valuable therapeutic measure in these cases is the use of the Russian or Turkish bath or an improvised hot bath by means of a lamp and a blanket. Baking the affected joint at a high heat is often very useful. (See Heat and Cold.) Liniments are always called for, for two reasons: First, they relieve pain and do good to the parts, if not from their medicinal properties, at least by the rubbing which accompanies their application; second, because they give the patient something to do or to have done, and therefore impress him with the object lesson that his attendants are attentive and alive to his suffering and need of sympathy and care.

Among the lower classes the belief in liniments is widespread, and their use will often instil into the minds of the friends a far greater confidence than the most rational of treatments with the liniment left out of the list of remedial measures. The following liniments will be found useful under these circumstances:

℞—Tincturæ aconiti		fʒvj (24.0)
Tincturæ opii		f℥j (30.0)
Olei terebinthinæ		f℥j vel f℥ij (30.0–60.0)
Linimenti saponis	q. s. ad	℥viij (240.0).—M.

S.—Poison. Use as a liniment three times a day.

Or,

℞—Aquæ ammoniæ fortioris		fʒiv (16.0)
Olei cajuputi		fʒj (4.0)
Tincturæ belladonnæ foliorum		f℥j vel f℥ij (30.0 60.0)
Linimenti camphoræ	q. s. ad	f℥viij (240.0).—M.

S.—Poison. Use as a liniment when skin is not inflamed.

Or,

℞—Tincturæ aconiti		f℥j (30.0)
Tincturæ opii,		
Aquæ ammoniæ	āā	fʒiv (16.0)
Linimenti chloroformi		f℥vj (180.0).—M.

S.—Poison. Use as a liniment to chronically inflamed muscles or joints.

In other instances the greatest relief is obtained by employing the following ointment:

℞—Veratrinæ	gr. xxx (2.0)
Hydrargyri iodidi flavi	ʒj (4.0)
Adipis lanæ hydrosi	℥ij (60.0).—M.

S.—Use as an ointment over the joints.

This ointment ought not to be widely distributed, and the pulse and respiration should be watched, as the veratrine may be absorbed and depression of a severe character set in.

For the reduction of enlargements of the joints due to the disease, and accompanied in some cases by pain, the following ointment is serviceable:

℞—Unguenti iodi	℥j (30.0)
Adipis	ʒiv vel ℥j (15.0–30.0)

S.—Apply locally.

Or, still better,

℞—Ichthyolis	ʒiv to ℥j (15.0-30.0)
Adipis	℥j (30.0).—M

S.—Rub into the joints thoroughly.

In many cases ichthyol is certainly the most efficient remedy for the enlarged and painful joints.

The employment of red flannel over the inflamed joints is no better than the use of white flannel, and it is never beneficially "medicated," as claimed in the stores. The only advantage of red flannel is that, as it is dyed, the wool is often better for not being thoroughly bleached, and is in larger amount. The disadvantages of red flannel are that if the patient sweats the dye stains the clothing, and the possibility of its producing irritation of the skin or even systemic effects of an evil character.

It is important to remember that many cases of "rheumatism" are, in reality, due to muscle strains produced by deformity, as disease or weakness of the spine or flat-foot, or to infected foci in the tonsils jaws or prostate. (See Feet.)

RHUS POISONING.

A multitude of methods for treating these acute lesions of the skin have been advocated. Probably the best is that of McNair. If blisters are present puncture them; the part is washed with a 5 per cent solution of ferric chloride in 50 per cent alcohol, then dried by the aid of an electric fan, after which the part is covered by applying paraffin (paronax), as in the treatment of burns. (See Burns.) Finally a thin sterile gauze dressing is used. If the condition of the skin is moderate, the ferric chloride treatment alone may suffice. If the lesions are slow in heating they are treated with Carrel-Dakin solution or hychlorite.

In these days, when it is difficult to obtain alcohol, a 5 per cent solution of ferric chloride in water and glycerine half and half is useful, care being taken that the arm is dried after application. In other instances a 5 per cent solution of potassium permanganate may be used. The stain it produces may be removed later by lemon-juice or 3 per cent of oxalic acid.

RICKETS.

Rickets may be defined as a state of the body of an infant or child in which there is a deficiency of the normal salts of the bones and tissues, with corresponding enlargement of the organic portion of the bone, or, in other words, the cartilaginous parts. Generally the term is applied solely to designate bony troubles, but every practising physician sees cases where the manifestations of rickets are emphasized in gastro-intestinal disorders rather than in bony deformities. The chief causes of rickets, aside from lack of sunlight and fresh air is inanition; that is, malnutrition of a specialized form, or, in other words, bone-salts and vitamine starvation. This may occur after or before birth, and it is quite common to see children, born of mothers ill-fed or whose assimilation of salts is defective, with soft bones or a distinct tendency to rickety development. In other cases the condition is chiefly one of failure of assimilation rather than of starvation of bone salts. (See Vitamines and Ergosterol under Vitamines, Very Important.)

Aside from sunlight, fresh air and the use of vitamines the treatment of rickets is largely dietetic and devoted to the improvement of the food and digestion. In the presence of this disease no part of the body fails in force more than the digestive apparatus, probably because the character of the blood is altered and partly because the stomach cannot secrete properly-formed juices from imperfectly nourished glands.

The medicines used in rickets are general tonics, digestives and stimulants, and bone tonics, such as salts of lime and soda. The general tonics are cod-liver oil and syrup of iodide of iron. The cod-liver oil supplies the needed vitamines, and regulates calcium and phosphorus metabolism. (See Cod-liver Oil, Part II.)

Where a distinct scrofulous tendency exists and anemia is present, small doses of the syrup of the iodide of iron are particularly of service, and ½ to 1 minim (0.03–0.06) may be given three or four times a day to a child of six months or a year, thus:

℞—Syrupi ferri iodidi . . . . gtt. xij vel xxiv (0.8–1.5)
Aquæ destillatæ . . . . . . q. s. ad f℥iij (90.0).—M.
S.—Teaspoonful (4.0) every four or five hours during the day.

Or,

℞—Syrupi ferri iodidi . . . . gtt. xij vel xxiv (0.8–1.5)
Syrupi . . . . q. s. ad f℥iij (90.0).—M.
S.—Teaspoonful (4.0) three times a day, after meals.

The ventilation of the rooms where a child prone to rickets is kept should be excellent, not too hot or cold and free from draughts. A cool sponge bath is useful at night if the patient is strong enough, or a good rubbing with salt and whisky, 1 dram (4.0) of salt to a pint (480 cc.) of whisky, is of still greater service.

Special attention should be paid to the development of the muscles by massage and passive movements, as these parts are always weak. Walking must not be allowed too early, as it may cause bony deformities. (See Vitamines and Heliotherapy.)

Of great importance is sunlight which has not passed through window glass. When this cannot be had the rays from a mercury-quartz lamp applied for a short time each day are useful. Even the rays from a *carbon* filament electric lamp do good.

RINGWORM.

As is the case in many other conditions, the multitude of remedies for this condition is proof of failure in treatment in a large percentage. The roentgen-rays undoubtedly, if properly applied, are useful, as are various ointments. The so-called Robertson method seems to be one of the most successful. This consists in first cutting the hair of the entire head as short as possible, or, if necessary, shaving it. The scalp is then thoroughly washed with ether soap and dried. After this the following lotion is applied by means of a small cotton applicator: Calomel, 5 grains; tincture of iodine (2 per cent) 1 dram; the mixture being stirred with a glass rod until a brick-red precipitate is formed.

While in some cases it may be possible to treat the whole scalp, this application may be too irritating when so generally employed, and, therefore, it is often wise to divide it into several areas, one of which is tried each day with the lotion. The lotion should be daubed on and not rubbed in, and Robertson asserts that it must be freshly prepared for each application. The lotion must not be applied so freely as to run from the scalp on to the skin of the face or neck.

Those parts of the scalp which have not been treated with the lotion are then to be well rubbed with ammoniated mercury ointment, and the entire scalp covered with a tightly fitting skull cap or bandage, which bandage ought to be carefully washed and sterilized when it is removed. The following day those parts of the scalp which were not treated on a previous occasion are washed with ether soap, and the lotion is applied, followed by the ointment. This plan is continued each day until all of the five or six areas have been treated. Occasionally, if the scalp is unduly sensitive a good deal of irritation may be produced by the lotion, which may be relieved by the application of a mixture of 3 parts of olive oil and 1 part of castor oil, or if the ether soap causes too much smarting a freely lathering soap, such as a shaving soap, will prove advantageous. If the condition is exceedingly persistent a little later a final treatment applied all over the scalp may be necessary. After the last patch has been treated the head is to be shampooed every morning with ether soap, followed by the rubbing-in of the olive oil and castor oil mixture already referred to, and this is continued until all the scurf has separated and the scalp looks clean and healthy.

According to Robertson's experience, a cure can usually be obtained in about two weeks. It is important to remember that other parts of the scalp may be infected, where infection has not developed sufficiently to be manifest. If these spots are overlooked the disease may break out a second time. The greatest care should be exercised to examine the other members of the family lest they reinfect the patient, and in the disinfection of all clothing used by night or day lest the patient infect others.

Jackson recommends the rubbing into the part of 1 dram (4.0) of iodine crystals in 1 ounce (30.0) of real goose grease. This grease has greater penetrating power than ordinary fats and usually is effective by the end of three weeks, the ointment being applied night and morning until some redness of the skin appears, when it is used once a day. Depilation is not necessary, for the hair soon falls out, but is supplanted by a new growth. This application may burn slightly, but is not really painful. (See Thallium Acetate, Part II.)

SCABIES.

As is well known, sulphur in some form has been used for decades treating scabies. In most instances an ordinary sulphur ointment requires prolonged use to be successful. In all cases it is needful to sterilize all the day and night clothing and the bed clothes of the patient. Probably the best plan to pursue, because of the rapidity with which a cure is effected, is that of the Dane, Marcussen.

The ointment is difficult to prepare, and has to be made up by a very competent pharmacist.

Dissolve 1 kilogram of sublimed sulphur at a gentle heat in 2 kilograms of a 50 per cent solution of potassium hydroxide, forming thereby a clear yellow fluid. Next, mix without heating, 225 grams of petrolatum in a similar quantity of water-free lanolin. To this mixture add 375 grams of the sulphur and potassium hydroxide solution. Then make fresh zinc hydroxide by mixing 28 grams of zinc sulphate and 40 grams of a 20 per cent solution of sodium hydroxide, and add to the ointment already prepared, after which add liquid petrolatum to make a total weight of 1000 grams. Last of all, add 5 grams of benzaldehyde to cover the somewhat disagreeable smell of the resultant sulphuretted hydrogen.

In this treatment it is, of course, the high sulphides of potassium which are the chief elements in developing sulphuretted hydrogen when the ointment is placed on the skin of the patient.

SCARLET FEVER.

The specific treatment of scarlet fever consists in the early use of antiscarlatinal serum (see Part III) if toxemia is at all marked. Although it greatly modifies the severity of the disease it does not always prevent the streptococci from producing secondary lesions as in the ear or elsewhere, if used late.

Absolute rest in bed is to be insisted upon as thereby sequelæ are largely avoided.

A milk diet alone or fortified by the use of carbohydrate gruels, not broths, partly predigested by taka-diastase should be rigidly followed.

The convulsions which rarely usher in an attack are to be treated by the use of the warm pack or hot bath (Part III), and if need be, 5-grain (0.3) doses of chloral and 10 to 20 grains (0.6–1.3) of bromide of sodium given by the rectum for a child of five to eight years. The convulsions of the advanced stages are often uremic, and must be treated accordingly. (See Uremia.)

From the very beginning of an attack to its end the child should always be supplied with plenty of pure water, and, if possible, this water should be obtained from a spring containing a low percentage of solids, as Poland water, which is widely sold throughout the United States, unless dropsy is present. If this is impossible, then Célestins Vichy water may be employed. The object of this treatment is to flush out the kidneys, and to so dilute the toxic substances generated in the body, by the fever and the germs of the disease, that they lose, to a great extent at least, their poisonous and irritating powers. If the child is so young that it takes food from a nursing bottle, Poland water may be placed in the bottle.

In other cases a prescription containing sweet spirit of nitre and citrate of potassium proves useful, as follows:

℞—Spiritus ætheris nitrosi . . . . f℥j (30.0)
Potassii citratis . . . . ʒij (8.0)
Aquæ destillatæ . . . . q. s. ad f℥vj (180.0).—M.
S.—Teaspoonful (4.0) every two hours if the urine is highly acid until it is part neutral.

Scanty urinary flow due to vomiting and deprivation of fluid should be treated by the use of the rectal drip (see Peritonitis), but the free use of water by the mouth or drip is to be avoided if anasarca is threatened or already developed. The use of daily hot packs is also useful to relieve the kidneys of congestion and quiet nervous irritability. If the fever contraindicates a hot pack to the entire body a pack may be applied from the level of the nipples to the pelvis.

Probably the most common complications calling for treatment when the kidneys have been treated in the way just spoken of, are high temperature or fever, and sore-throat or angina. The fever is to be controlled in these cases in precisely the same way that it is in all other conditions in which it is present. It is best to attempt to keep it below 102° F., by tepid sponging, which also allays the itching of the skin, or, if the temperature continues to rise, by the use of cool water. When the patient is overcome by toxemia, the skin marbled and mottled, and the brain stuporous, he should be given a wet pack. In very young children the same effect may be obtained by dipping the patient alternately in hot and cool water. The object is to cause reaction and equalize the circulation. If suppression of the rash occurs the wet pack must be used. (See Heat, Part III.) Where the head seems to be particularly hot, and the fever is high, an ice-bag or a head-coil of rubber tubing is to be employed, and through the latter water may be circulated at whatever temperature is thought best. (See Cold, Part III.)

In cases where the eruption suddenly fades or is never well developed it is of the greatest importance that it be made active. Under these circumstances the child may be placed in the warm wet pack, and, if the head is very hot, cold applied to the vertex and throat while the body is enveloped in the blanket. (See Heat.) This often brings out in an hour or two a bright scarlet rash, and the child falls asleep and wakes up free from delirium and high fever.

The treatment of the sore-throat of scarlet fever is an important part of the care of the child in many cases. Small pellets of ice may be held in the mouth and an ice-bag applied to the outside of the throat. This is done by finely breaking some ice and placing it in a thin India-rubber bag about the neck, the surface of the bag being covered by a cloth to prevent too rapid melting of the ice and the wetting of the clothes by the condensation of moisture on the surface of the bag. This treatment may be used during the entire attack if needed, and the contents of the bag renewed as often as the water becomes at all warm from the heat of the body. By this means the redness of the fauces and the swelling of the glands of the neck are relieved. Chlorate of potassium may be used in a spray or on a swab, but never internally owing to its irritant effects upon the kidneys and stomach and its general influence on the blood. When a false membrane forms, antidiphtheritic serum is to be given until a bacteriological examination shows that it is not due to the Klebs-Loeffler bacillus. This membrane should be locally treated by applying peroxide of hydrogen.

The itching and burning of the skin in many cases of scarlet fever are annoying symptoms, and they may become really dangerous. Fever of high degree can be brought on solely through nervous irritation, thus explaining a fact long well known to clinicians—namely, that the relief of this dermal irritation in scarlet fever may be followed by a fall of temperature. To relieve this symptom it will often be found advisable to cover the entire skin with a thin layer of benzoated lard. Oftentimes a warm pack will relieve this symptom. In other cases almond oil should be used. These symptoms are relieved by the use of the proper serum.

If nephritis comes on and in a severe form, the greatest care is necessary, and the object of the physician must be to make the skin, disabled as it is, carry out sufficiently an active eliminative function to relieve the kidneys of strain. It is well to aid in the removal of effete matter by producing mild catharsis. Sweating may also be produced by the employment of heat obtained by the use of the hot pack or the mustard pack. (See Heat.) The thermometer must be placed in the mouth to foretell any danger from heat-stroke if the sweat should fail to appear

The after-treatment of scarlet fever during convalescence, if treatment is needed, consists in the use of Basham's mixture or the tincture of the chloride of iron, and in the employment of simple bitters, strychnine, or quinine. Fresh air, sea air, or mountain air is useful, while cold or exposure to cold air or draughts is to be carefully guarded against.

The view has been that the desquamated skin is the active factor in distributing the infection. If this be true it can be controlled by the use of oil inunctions and quarantine. The nasopharyngeal discharges are the chief agents in spreading infection, and these passages should be sprayed daily with normal salt solution and followed by the dropping of a 10 to 20 per cent solution of silvol into the nostrils and this in turn followed by a few drops of liquid abolene.

SCIATICA.

Sciatica is an exceedingly obstinate affection, in many cases resisting the best treatment for weeks. So-called sciatica is often due to lumbo-sacral or sacro-iliac strain. In other cases the pain is really due to hip-joint disease. (See below.)

The treatment for true sciatica is both internal and external. The internal treatment may be the same as that already described under Acute or Chronic Rheumatism, or in other instances consists in the use of large doses of bitartrate or citrate of potassium, 40 grains (2.6) three times a day, in plenty of water to aid in the maintenance

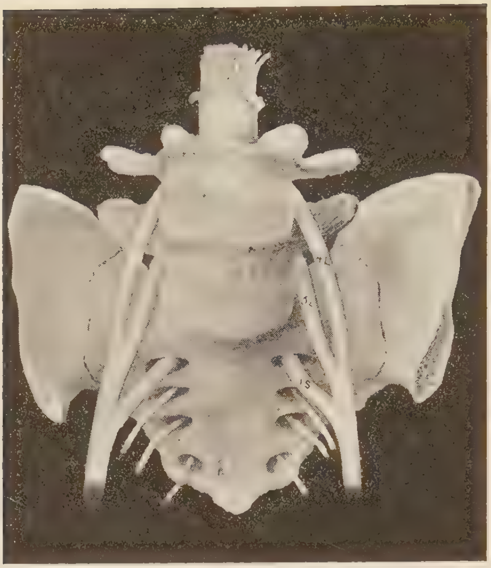

FIG. 138.—The figures with lettering show the nerve trunks. (From article by Ayres in New England Journal of Medicine, 1929.)

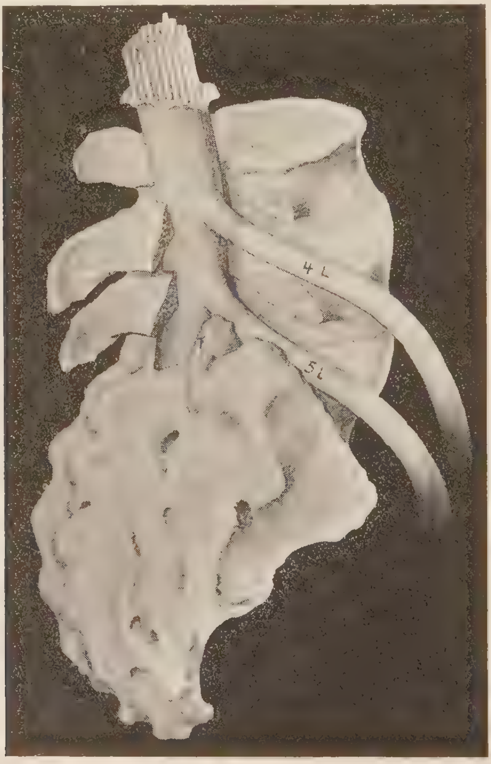

FIG. 139.—Posterolateral view. (Ayres article. Ibid.)

of free kidney action. If the pain is excessive, morphine should be given, or acetylsalicylic acid, antipyrine, or acetanilid may be used. In some instances methylene blue in 5-grain (0.3) doses twice or thrice a day has seemed to relieve pain. (See Methylene Blue.)

In acute cases, from 3 to 5 large wet or dry cups, preferably the wet, may be placed along the course of the sciatic nerve with great advantage. In many cases absolute rest of the limb, obtained by placing it in splints, has to be adhered to before cure is possible. In other instances the nerve should be exposed and any adhesions broken up. Hot-water bags should be placed continually about the exit of the sciatic nerve from the pelvis.

The liniments recommended in chronic rheumatism may be tried, and cod-liver oil is of service in some obstinate cases.

Pain along the sciatic nerve arising from lumbo-sacral or sacro-iliac disease is readily explained by recalling the anatomy of these parts as shown in Figs. 138 and 139 in which it is seen that some of the nerve fibers forming the great sciatic nerve arise from the area of the fourth and fifth lumbar vertebræ and the first sacral. Inflammation or chronic arthritis at those points results in pain in the nerve trunk. Such cases are to be treated by strapping the parts, the use of a belt, or by the skill of the orthopedic surgeon. The use of the infra-red light over the parts is also advisable.

SCLERITIS.

(See Episcleritis.)

SCROFULOSIS.

(See Adenitis.)

SCURVY.

The cure of this state is so completely dependent upon the use of proper foods that almost no drugs are to be employed in its treatment. (See Heliotherapy.)

The only remedies particularly indicated are orange- or lemon-juice or lime-juice and tomato-juice. Beef-juice is also valuable. Arsenic and iron are of service in most cases, and rest and quiet are to be insisted upon with plenty of fresh air and sunshine.

By far the more common form of scurvy is seen in bottle-fed babies. The child may or may not have rachitic manifestations. Generally it loses animation, becomes listless and peevish, evidently suffers pain in its body and limbs when it is lifted from the bed, and looks feeble and wan. The gums become spongy and swollen, and have an ecchymotic appearance, and light blows produce bruises out of proportion to the severity of the injury. The treatment of infantile scurvy is a complete rearrangement of the child's diet-list, and varying its food. No one baby food should be used to the exclusion of another, and sterilized milk is to be supplanted, if possible, by fresh new milk. It is important to remember that a large proportion of these occur in the children of the rich, who have subsisted largely on prepared "Infant Foods." (See Vitamines and Feeding the Sick, Part III.)

SHOCK.

The term shock is applied to a state in which the patient is in collapse as to his circulation and nervous energy. It is to be distinctly separated from syncope in which unconsciousness is present. The patient is often seemingly benumbed as to his mentality and may be profoundly apathetic, although, if spoken to, it is found that his intelligence is preserved even if he be so feeble that he does not speak in reply. It is unfortunate that very different states are described under this term and it is practically certain that the symptoms, although they may be similar in different persons, are nevertheless due to different causes and often to varying quantities of each cause. In other words, the cause of the condition is complex, not simple. All attempts to prove that shock is produced as the result of a single factor have failed. It is not possible in this space to deal with all the different theories as to cause but only with the dominant conditions present and what can be done for their relief. These dominant conditions are a marked fall in blood-pressure and a tendency to arrest of heat production and an increase of heat dissipation. The fall of blood-pressure is to be combated by the use of atropine given in full dose intramuscularly, since atropine tends to restore circulatory equilibrium by contracting the bloodvessels in the splanchnic area and dilating the peripheral vessels. The use of normal saline intravenously is of little value because the vessels dilate as fast as the fluid flows in and unless the fluid is hypertonic it may transude into the tissues. (See Intravenous Injections, Part III.) To prevent this a hypertonic solution is useful, say one of 1.0 instead of 0.9. A transfusion with whole blood is better still if hemorrhage has been a factor. The patient should not be put flat but rather be placed in the Fowler position and should not be oppressed by being buried in soft pillows. Strychnine and particularly caffeine should be given intramuscularly in some cases in full dose. These drugs if used before exposure to the cause of shock may make the body unduly susceptible to it, but after the insult the caffeine in doses of 3 to 6 grains rouses the nervous activities of the patient and calls in his reserve energies. The use of alkaline injections to combat so-called acidosis, while advocated by some observers, has not proved efficient and it has not been proved that acidosis is the cause of the symptoms or that the acidosis said to be present is sufficiently severe to produce them. Porter has urged the use of CO_2 inhalations on the basis that by increasing the amount of that gas in the blood the dominant vasomotor center is stimulated to greater effort to raise pressure, and there are good physiological reasons, as well as clinical results, to support this view, but it has not proved very useful. The greater amplitude of thoracic movement under such inhalations tends, however, to pump the blood from the great venous trunks into the heart. We are too prone to forget the importance of respiratory movement as a circulatory factor. The greatest care should be taken that the patient is moved about as little as possible, that he have absolute quiet, and above all things that he be not exposed to cold. External heat should be applied to the extremities, but not so as to oppress him as it often does if his chest is packed about with hot-water bags. Hot normal saline may be given by means of the Murphy drip. (See Peritonitis.) If the heart flags some preparation of digitalis suitable for hypodermic use should be given in full dose intramuscularly, but the rapid or feeble pulse is more the result of low blood-pressure than of actual cardiac weakness. (For the use of adrenalin and pituitrin in vascular collapse, see Suprarenal Gland and Pituitary in Part II.)

SMALLPOX.

The treatment of smallpox is not specific, simply because it is one of those diseases which run a given course and which cannot be aborted. We can only treat the various symptoms which present themselves, and by the modification of these manifestations prevent complications and sequelæ to some extent. The fever is to be treated as is any fever of this class. Often it can be allayed by a mixture containing, spirit of nitre, and spirit of Mindererus (liquor ammonii acetatis), while the headache or backache may be controlled by small doses of antipyrine or acetanilid. Mustard-plasters are not to be used for the backache, as the dermal irritation will increase the eruption. Insomnia and restlessness, if excessive, are to be quieted by the bromides or chloral, care being taken that the doses of the latter are not large enough to depress the heart. It must be remembered that the time of onset of the secondary fever, the eighth day, is one of grave import to the patient. More patients die from this secondary septic infection than from the disease itself. Before its arrival the treatment of the case must be so managed that strength is saved for this strain, and tincture of the chloride of iron, in 5- to 10- (0.3–0.6) or even 20-minim (1.3) doses, may be resorted to to give strength to the patient and to help control the pyemic fever. The pulse should be watched, and if it flags, brandy and whisky should be freely but wisely used. At the same time nourishment in the shape of egg-nog, milk-punch, and rice and barley gruels should be given as freely as the digestion will allow.

The peripheral irritation and itching of the eruption are a cause of the fever in part, and produce much unrest and nervous irritability.

The condition of the skin is therefore to be looked after and pitting prevented, if possible, by every means in our power, particular care being taken to prevent its development on the face. One of the means which has been recommended to prevent pitting is the use of flexible collodion, and another application is glycerite of starch or simple cerate applied in a heavy coating. Some physicians recommend inserting the tip of a nitrate of silver stick into each vesicle as it ruptures, to prevent pitting. All of these measures are futile in most cases and the use of collodion is probably harmful in some instances. The best application to use is made of 4 parts of salicylic acid to 100 parts of vaseline or cold cream. Sometimes anointing large areas of the body with sweet oil slightly phenolized (1 to 100) is useful to check irritation.

If the mouth is sore, a mouth-wash of chlorate of potassium and water may be used, flavored with a little tincture of myrrh. (See Chlorate of Potassium and Stomatitis.)

Disinfection, good ventilation, and the avoidance of much light are necessary.

SPLENOMEGALY.

Enlargement of the spleen, to a moderate degree, is commonly associated with many acute infections and has little therapy. Splenomegaly as a symptom of leukemia of the myelogenous type, or as it occurs in so-called splenic anemia, hemolytic jaundice, hemorrhagic purpura and pernicious anemia is little influenced by drug therapy except for temporary remissions. (See Arsenic in Part II and Pernicious Anemia in Part IV.) At present it would appear that the best results follow splenectomy, if done by a skilful surgeon, in the early stages of Banti's disease before there is much involvement of the liver. When associated with purpura hæmorrhagica care must be taken to determine the state of the blood, for if thrombocythemia is present, the operation is prone to be followed by multiple abdominal thromboses. This danger does not exist if there is a thrombocytopenia, that is a low platelet count, unless the condition is acute. In pernicious anemia, and particularly in leukemia, it is useless and dangerous to operate.

SPRAINS.

In every case of severe sprain it is best to roentgen-ray the joint in order to be sure that a fracture has not occurred. The various measures for the relief of pain and swelling will be found in the therapeutic index under the above heading. Soaking the part in as hot water as can be borne is useful at first.

From the mechanical standpoint the aim is to protect the joint from further injury and to permit restoration of function at the earliest possible date. For this purpose strips of zinc oxide plaster may be applied, as is shown by Fig. 140, when the ankle is involved.

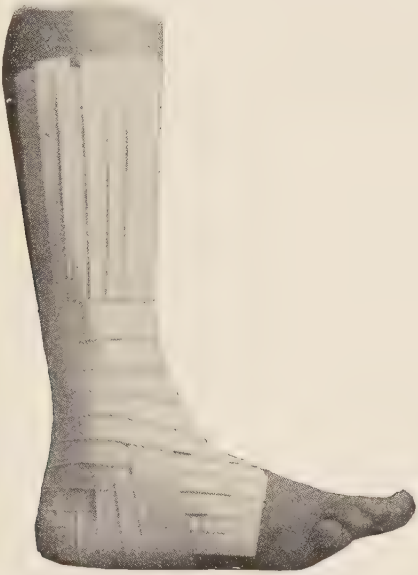

Fig. 140.—Strapping applied to ankle-joint.

STINGS AND BITES.

The stings of nearly all small insects depend for their activity upon formic acid, and are to be relieved by the use of dilute alkaline liquids, or, better still, by the application of ammonia, or, instead, an application of ordinary or flexible collodion may be made, or, if preferred, salicylic acid may be added in the proportion of 5 grains to the ounce (0.3–30.0), which is improved in its action by the addition of 1 part of mercury bichloride to 1000 of the collodion, or water of witch-hazel may be applied. Sometimes a solution of phenol, 1 to 100 or 1 to 50, when sponged over the parts exposed, not only relieves the itching of mosquito-bites, but also repels the mosquitoes. In other instances the stings are relieved and cooled by the use of dilute or pure vinegar.

A useful application to prevent mosquitoes from biting is:

℞—Olei citronellæ . . . . f ʒj (4.0)
Alcoholis . . . . f℥j (3.0).—M.
S.—Apply freely to the skin exposed or use the pure oil.

In snake-bite the best treatment consists in sucking the wound, as snake-venom, even if swallowed, is not poisonous. The part should then be freely incised, so as to cause the blood to flow freely, and immediately the wound should be filled with permanganate of potassium, and full doses of this drug injected deeply about the wound, the salt being diluted three-fourths with water, and followed by full doses of ammonia given by the mouth. The secret of successful treatment consists, however, in the use of a ligature above the bitten spots and the opening of the wound as soon after its reception as possible, thereby preventing absorption of the poison. Antivenine and antitoxins promise much for treatment in the future.

STOMATITIS.

This annoying affection is most commonly seen in children, and is characterized by the appearance on the tip and sides of the tongue, lips, and lining membrane of the mouth of small spots which sometimes have a reddened zone around them, and which result in minute or large ulcers.

The best treatment, if the kidneys are not acutely inflamed, is the use of the following prescription, which largely depends for its value upon the potassium salt used:

℞—Potassii chloratis	ʒj (4.0)
Tincturæ myrrhæ	gtt. xx (1.3)
Elixiris calisayæ	f℥iij (90.0).—M.

S.—Teaspoonful in water every four hours.

As the chlorate of potassium is eliminated with the saliva, it not only does good when taken into the mouth, but is also active all the time that it is being eliminated. If the stomach is disordered, the same preparation may be used as a mouth-wash. Often constipation is present, and it should be relieved by salines or by rhubarb in the form of the aromatic syrup. Another remedy which is very efficient in stomatitis is borax, used as a mouth-wash, in the strength of 10 to 15 grains to 1 ounce (0.6–1.0 to 30.0) of water and honey, as follows:

℞—Sodii boratis		gr. xxx (2.0)
Mellis depurati		fʒiij (12.0)
Aquæ destillatæ	q. s. ad	f℥iij (90.0).—M.

S.—To be used on a swab or as a mouth-wash every four hours.

This also may be given internally to adults in the dose of a teaspoonful (4.0) every three hours.

In many cases peroxide of hydrogen in the proportion of 1 ounce (30.0) to 8 ounces (240.0) of water proves a valuable mouth-wash.

In adults when stomatitis is associated with *pyorrhea alveolaris* the following is useful:

℞—Acidi salicylici,		
Acidi benzoici	āā	gr. xv (1.0)
Tincturæ krameriæ		fʒiss (6.0)
Alcohol. absoluti		f℥j (30.0).—M.

S.—Teaspoonful to a small wineglassful of water as a mouth wash.

If the liver is at fault and is torpid, nitrohydrochloric acid is useful. When the spots do not readily yield to treatment they may be touched with the tip of a stick of silver nitrate, which, while it is momentarily painful, is very efficacious. Neo-silvol is useful.

Nearly always with this disease in childhood there is considerable fever, vomiting, and wakefulness at night, with fretfulness and crying during the day, and total refusal of food, not because hunger is absent, but because the food hurts the mouth and is rejected with a cry of pain as soon as it touches the lips. The food should be very soft milk-toast for older children, or milk with lime-water in it in large amount for infants fed by the bottle. If a child at the breast be attacked, the mother's nipple should be carefully washed with boric-acid solution after each nursing. A warm foot-bath at night is often necessary to produce rest, and 10 minims (0.6) of sweet spirit of nitre thoroughly diluted may be given with advantage to a child of one or two years. If the irritability of the nervous system is excessive, bromide of sodium or strontium in the dose of from 1 to 10 grains (0.06–0.6), according to age, three times a day, is of service, and may be added to the mixtures already named, or, better still, given alone, well diluted with syrup and water.

After the attack tonics and a carefully selected diet are generally necessary.

When thrush or babies' sore mouth is present boric a cidor borate of sodium is of little value and the best results will accrue from swabbing the entire mouth with a 1 per cent solution in water of gentian violet. The use of this dye while it is efficient possesses the disadvantage of its stain. Sodium perborate is useful. (Part II.)

STYES.

A stye is a localized inflammation of one of the glands (Zeiss's gland) in the margin of the lid or of the surrounding connective tissue. Pain may be alleviated with frequently changed hot compresses (water 110° F.). Abortive treatment has been recommended and practised by massaging the swelling with a salve of the yellow oxide of mercury (2 grains to ʒj), or by painting the surface with an ethereal solution of collodion, but such measures are of little avail, and an incision into the tumefied area to liberate the pus is promptly indicated. Associated conjunctivitis requires a boric-acid solution for its relief. It should be remembered that styes indicate ill health; they often occur with anemic conditions in young women with menstrual disturbance. They most frequently appear in the subjects of refractive error, hence suitable glasses are required. When they tend to recur in crops the internal use of sulphurated lime has been recommended.

In stubborn cases treatment with autogenous bacterial vaccines achieves excellent results.

SUNSTROKE.

Sunstroke—or, more correctly speaking, heat-stroke—is an affection produced by exposure of the body to any form of high temperature, whether the source of heat be the sun, a furnace, or the radiation of heat from the earth. For this reason the condition may occur as readily at midnight as at mid-day.

Heat-stroke is to be divided into two classes, in one of which excessive exposure to heat upsets the balance of the thermal mechanism of the body, so that fever (thermic fever) comes on; in the other the temperature is lowered and forms the condition known as heat-exhaustion.

The condition of thermic fever is very frequently seen, while heat-exhaustion is rare.

The treatment of these two states is, of course, radically different. When a patient has thermic fever and comes under the care of the physician, the first thing to be done is to loosen the clothing—if possible, remove it—and if the pulse be bounding, the face cyanotic, and the heart laboring, to bleed him freely. At the same time intravenous injection of normal salt solution should be freely resorted to, and this is particularly needful if the blood flows slowly and is very dark in hue. (See Intravenous Injection.) At the same time cold should be applied to the body, and particularly to the head, abdomen, back, and chest. The man should be stripped, laid upon a bed, which must be covered with a rubber blanket, and ice-water applied to the body by means of a sponge, or a piece of ice may be laid on the head, while another piece is rubbed over the rest of the body. While this is being done the surface of the patient's body *must be thoroughly and briskly rubbed in order* to bring the hot blood to the cooled skin. The cold applications are to be applied chiefly to the great muscles of the back with active friction.

Care should be taken that the temperature, when it once begins to fall, does not drop suddenly below the normal and cause collapse. If the clinical thermometer in the mouth or rectum shows that the temperature has fallen to 101.5° or 100° F., the cold application should be stopped, and the patient allowed to lie on a bed, covered only with a thin sheet. The bodily temperature must be constantly watched, as it will probably bound up again in a few minutes, and require the application of more cold, used with the same care. This second rise is due either to the disorder of the nervous mechanism of heat production and dissipation, or to the fact that, while the surface of the body is cooled by the ice, the innermost viscera are still in high fever and rapidly heat the surface as soon as the ice is taken away. Antipyretics have been found to be almost useless in the hyperpyrexia of sunstroke, and are not to be relied upon.

After the fever has been reduced permanently the danger is not all passed, and it is the greatest mistake to discharge a patient as cured at this time. After two or three days it is very common for a meningitis to develop, accompanied, it may be, by little or no fever, but characterized by violent darting headache, which is made worse on lying down or on sudden movement. The treatment of this state must be bold, and venesection is the only safe method of obtaining relief, although vascular sedatives, such as veratrum, may be employed. The bleeding should be copious enough to impress the circulatory system to some degree, and may be done by opening any of the prominent veins in the arm. (See Venesection.) Sometimes a violent attack of epistaxis saves the man's life when it would have been lost through the ignorance of his attendant. If life is preserved without vascular depletion, secondary changes in the brain may ensue and produce hemianopsia, optic atrophy, imbecility, or insanity. Quinine, salicylic acid, and similar substances are all contraindicated under these circumstances, because of the congestion of the meninges to which they predispose by their physiological effects.

The treatment of heat-exhaustion consists in the use of heat instead of cold, in order to restore the bodily temperature. Just here, however, must be uttered a word of warning—namely, that the mere fact that the skin is cold does not prove the case to be one of heat-exhaustion, since a rectal thermometer may show the central or real temperature of the body to be that of hyperpyrexia. Of course, such a case should not receive hot, but cold, rectal injections if the symptoms require it.

The body heat in heat-exhaustion is to be raised by placing the patient in a bath at 105° to 110° F., or by the use of hot bricks or bottles, care being taken that they do not burn the patient. The body temperature should also be watched, lest the other extreme of heat be reached. Atropine should be deeply injected into one of the great muscles.

Cases of heat-exhaustion are not so apt to have meningitis as are cases of sunstroke, but they are generally slow to convalesce, and require tonics and careful watching for a long time. Indeed, in many instances the system seems to receive a shock from which it takes several weeks or months to recover.

SYPHILIS.

An indolent sore, which appears without immediate and adequate preceding cause, persists for days and weeks, gradually growing larger and harder, and which is accompanied within seven days from its appearance by hardening and enlargement of the anatomically associated lymph nodes is usually a chancre. If the spirochetes are found it is surely so, and almost as surely if it disappears in a few days under specific treatment. The Wassermann test is negative for the first three or four weeks following the appearance of a chancre.

When chancroid and syphilis are inoculated at the same time and in the same place a positive Wassermann in the fourth week will be probable. Often such mixed infection is not suspected until secondaries or tertiaries develop.

Once the diagnosis is reached the physician and patient must institute and persist in active treatment for months and the greatest care should be used to impress upon the patient that the treatment must not be a matter of weeks or even months, but possibly years. Furthermore he must be told that if he does not have persistent treatment he may suffer a whirlwind of disaster twenty years later in the form of paresis or locomotor ataxia. A sharp onset renders treatment obvious but it is never to be forgotten that the infection is prone to become like a smouldering fire in damp forest leaves. It is always at work and is always causing destruction if not combated. On the other hand a difference exists between the activity of an attack on the parasite in the later stages as compared to the early stages. In the later stages damage has been done by the infection which is, perchance, no longer very active and a line of treatment should be carried out consisting of small doses of antisyphilitic agents using these over long periods and one after the other. It is often a serious error to push them in an endeavor to induce a negative Wassermann test. This method of rotating our remedies is nearly always valuable in the acute cases also.

An excellent treatment of the hard chancre is to wash it with mercury bichloride solution 1 to 2000 leaving it moist for some minutes. Then wash the part thoroughly with sterile water. Wipe the surface dry with sterile gauze and apply a very thin application of scarlet red ointment 2 to 4 per cent and dress the part with gauze. A fresh dressing should be used daily. Each time the dressing is applied the part should be washed with bichloride solution after every particle of scarlet red is removed. (See Scarlet Red, Part II.) If the part becomes inflamed stop the scarlet red and use adeps lanæ.

The diagnosis of secondary syphilis is based on the history of a primary lesion; the typical skin manifestations, characterized by symmetry of distribution, polymorphism, coppery color and absence of itching; the mucous membrane lesions characterized mainly by the circumstance that nothing else can logically account for them; a positive Wassermann test, nearly always present, and the prompt curative effect of appropriate treatment.

The diagnosis of tertiary syphilis is dependent upon the history; at times upon the scars of previous lesions. As a rule, also upon the absence of other adequate cause for the symptoms present; at times, by the strikingly prompt and beneficial results of specific treatment. There is a positive Wassermann test in something more than 60 per cent of these cases. A negative Wassermann test is, therefore, of no diagnostic value.

Maternal syphilis usually gives no characteristic symptoms other than ill health otherwise inexplicable, and often a history of miscarriages without adequate cause. A positive Wassermann test proves the presence of syphilis; a negative reaction has not the contrary meaning.

Hereditary syphilis exhibits shortly after birth mucous membrane and skin lesions fairly characteristic of the secondary stage; or, skipping these, there may be in childhood, puberty or adult life, eye, bone, cardiovascular or cerebrospinal lesions, or lowered resistance and

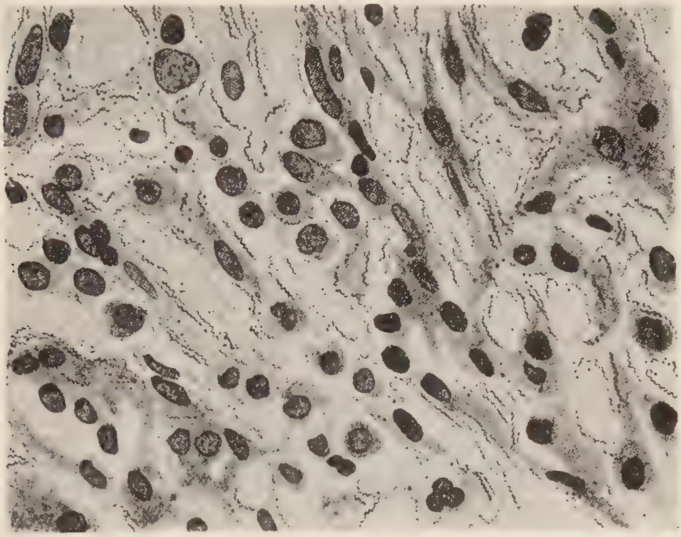

FIG. 141.—Section of a chancre stained with silver showing spirochetes. (Levaditi.)

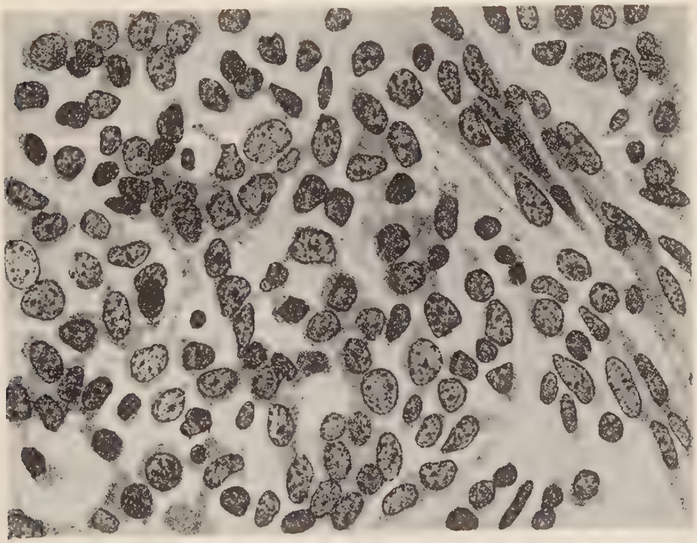

FIG. 142.—Section of same chancre four days after an intramuscular injection of bismuth. No spirochetes seen. (Levaditi.)

impaired vitality—none of them characteristic of the underlying condition. The Wassermann test is not largely helpful, being positive in about 50 per cent of the cases; nor are the patients always benefited by specific treatment.

Cerebrospinal syphilis exhibits as its most constant symptoms persistent headache, dizziness, and epileptiform convulsions. Treatment should begin with mercury—arsenic being used with caution.

In ataxia, paresis, and arteriosclerosis, the administration of arsenicals may be helpful but must be carefully guarded.

The most important single element in the treatment of syphilis is the maintenance of the patient's vital resistance at its highest point. This implies regular exercise, regular bowel movements, moderate eating, and the avoidance of all excesses or strains. The teeth should be put in order and kept clean. The patient's urine should be examined, his weight taken, and his cardio-vascular reserve estimated.

The proper treatment is that which passes as much arsenic and mercury through the patient's body as he can take compatible with eating well, sleeping well, feeling well, not being tired, and holding to normal weight.

The drugs used are arsenic, mercury, and, in the later stages, bismuth and potassium iodide. (See Part II.)

Arsenic by intravenous injection is given in the form of arsphenamine or neoarsphenamine.

Mercury is given (metallic mercury or calomel) by inunction; intramuscular injection (biniodide or salicylate); vaporization (calomel); or mouth administration (protiodide, biniodide, mercury with chalk). (See Mercury, Part III.)

Potassium iodide is of minor import, and not to be used in either the primary or secondary stage—is given in the form of an aqueous saturated solution, the required number of drops being added to milk, of which at least ½ glass is used to dilute each dose.

Arsphenamine is most efficient in the primary and secondary stages. Mercury is efficient in all stages.

Arsphenamine given intravenously implies both immediate and remote risk. The immediate risk is that incident to anaphylactoid shock, simulating as it does the phenomena incident to the injection of foreign proteins, and characterized by flushing of the face, metallic taste, nausea and vomiting, cough, heart hurry, distress inbreathing, cyanosis, syncope developing rapidly. Arsenical injections should be given slowly, since if these symptoms are observed promptly, and if the injection be stopped before a large dose is given, and adrenalin chloride (10 to 20 minims of a 1 to 1000 solution) be injected intramuscularly a favorable reaction takes place usually within a short time. (See Arsphenamine, Part II.)

The delayed symptoms of an over-dose of arsphenamine are loss of initiative, strength, weight, and appetite; often headache; at times, dermatitis; appearance of bile or blood in the urine and even the development of jaundice.

Hemorrhagic encephalitis incident to the treatment of cerebrospinal syphilis by arsphenamine without a preliminary course of mercury, beginning two or three days after the administration of the drug, may be inaugurated by mental confusion and dull headache, followed by convulsions, coma, and death.

To avoid this, in the treatment of cerebrospinal syphilis a course of mercury is indicated before the use of the arsenic preparations.

The earliest manifestation of renal injury incident to arsphenamine is polyuria without either albumen or casts, followed later by anuria. Renal hypersecretion suggests a temporary stopping of the drug or a lessening of the dose.

Arsphenamine should be used cautiously in conditions of depressed vitality or in the presence of cardio-vascular lesions (including aneurism) with failing compensation, hemophilia, advanced, nephritis, diabetes, tuberculosis or visceral lesions not luetic.

Mercury given in an overdose causes gingivitis—this being preceded by metallic taste and an offensive odor of the breath; casts and albumin in the urine—mercury being an epithelial poison; colicky pains and diarrhea, the stools even containing blood.

Offensive breath and metallic taste, usually the first signs of mercurialization, indicate the prompt stoppage of the drug.

Chronic mercurial poisoning is manifested by languor, despondency, failure of appetite, loss of initiative, and a steady loss of weight. This may occur without any gum, urinary or bowel symptoms and is an indication for stopping the drug.

The patient properly treated should feel better and not worse, should gain weight and not lose it.

During the course of treatment, the urine should be examined every two weeks; and the weight taken, recorded, and compared at least once a month.

The prospect of cure is in direct proportion to the timeliness and thoroughness of treatment.

Eight doses of arsphenamine or neoarsphenamine given at intervals of five days, constitute the first course. The average dose of arsphenamine is 0.6 and of neoarsphenamine 0.9 gram.

This treatment is supplemented by mercury, preferably by inunction, 1 dram unguent hydrargyri, or 2 drams of calomel ointment—being rubbed into the skin every day for six days. This followed by a rest period of from three to six days; six of these courses are given.

At the end of this course of arsenic and mercury, if the patient feels well and is without symptoms, a rest of one month is given, without treatment; then a Wassermann test is taken and regardless of whether this be positive or negative, a second course similar to that already indicated is administered.

Intramuscular injections of mercurial preparations are the fashion of the day. The preparation of choice may be either soluble or insoluble. Soluble preparations are rapidly absorbed, hence give prompt effect. They must be repeated frequently—every day or every other day until the indicated course is completed.

Bichloride, 1 per cent, dissolved in 0.6 sodium chloride solution may be used. The resulting mixture should be perfectly clear; the dose, every third day, is from $\frac{1}{6}$ to $\frac{1}{3}$ grain (0.01–0.02) driven well into the muscle. Six such injections are given followed by three days' rest.

Salicylate of mercury is the most approved of the insoluble preparations. The average dose is 10 minims in a 10 per cent goose grease suspension, repeated at intervals of from three to seven days. Six to twelve doses constitute a course. One cc. of a 1 per cent watery solution of mercury biniodide is very useful. (See Mercury Biniodide, Part II.)

If neither inunctions nor intramuscular injections be applicable mercury may be given by the mouth. Protiodide or other similar preparation, $\frac{1}{4}$ grain after each meal, with two days rest in seven. This dose is cautiously increased and should be continued throughout the course of the arsenical treatment—or following it. After a month's rest following the first course of treatment a second course should be given but mouth medication is very unreliable.

After the second course of treatment, a rest of six months is given, at the end of which time a Wassermann test is again made. If positive, the course is repeated as in the first instance. If negative, the treatment is discontinued for another three months, when a Wassermann test is again taken.

Even though the Wassermann remain negative, it is well for these patients, spring and fall, to take a brief course of mercurial treatment, and this for life.

A positive Wassermann test, many years after infection obtained in the coarse of routine examination does not necessarily indicate specific treatment if there are no symptoms manifesting syphilitic activity. (See Arsphenamine, Part II.)

If syphilis be seen in its secondary stage the dosage, intervals of treatment and medication are the same as those advocated in the primary stage, excepting that 16 arsenic injections instead of 8 are given. Mercury is alternated with the entire series of arsenical injections short of producing any constitutional symptoms of the drug. Thereafter, at intervals of three months a Wassermann test is taken and the course repeated, but is less prolonged. Thereafter, blood and spinal fluid Wassermann tests are taken at intervals of six months to a year. A positive Wassermann test at any time calls for a course of arsenic and mercury, gauged as to length and severity in accordance with the patient's capacity to maintain his health or make it better thereby.

In the tertiary stage of syphilis, arsenic and mercury are given as in the secondary stage. Exceptionally, and particularly when these drugs have little effect, potassium iodide may be administered in increasing doses, always stopping short of toxic symptoms. This is particularly true in regard to vascular lesions. If the iodides are beneficial at all, they manifest their effects promptly; their long continuance is always devitalizing. Their over-use is characterized by coryza, gastro-intestinal disturbances, eruptions of the skin, ringing of the ears, mental depression, and loss of weight and appetite.

For latent syphilis, mercury and arsenic are indicated, both being used with extreme caution; basing the continuance of treatment on the resulting better health of the patient.

Hereditary syphilis is controlled most successfully by treatment of both parents before conception and treatment of the mother during pregnancy. Syphilitic patients with positive Wassermann tests should not marry. The Wassermann should be negative for two years. If the Wassermann test be positive when marriage takes place, the expectant mother should be treated in accordance with the principles laid down for the treatment of primary and secondary syphilis, to wit, full courses of from eight to sixteen doses of arsphenamine, with mercurial inunctions. A syphilitic mother thus treated may give birth, indeed may be expected so to do, to a healthy child.

As to the syphilitic child, intravenous injection of neoarsphenamine 0.002 gram per pound body weight, may be given every two weeks until from four to six doses are administered. After an interval of six months the course of arsenic may be repeated. The arsenic should be supplemented by mercury inunctions.

An inunction is thus given:

The abdomen is washed with Castile soap and water, then with boric-acid solution. After thoroughly drying, $\frac{1}{2}$ dram of mercury ointment is rubbed into the skin.

An abdominal binder is then applied and worn for twenty-four hours, at which time the skin is washed and the ointment again rubbed in. The same binder is worn for four days. Four days rest are given after four such treatments and the course is repeated four times.

If the Wassermann test continues positive further treatments are given at intervals of six months for two years. Spring and fall treatments throughout life is advocated for these syphilitic children.

An important point to be borne in mind in old cases of syphilis is that lapse of time, alone, without treatment, may result in a negative blood and spinal fluid Wassermann test without meaning that the diseased condition is not progressive. In these cases fairly moderate treatment, as compared to that of acute cases, is usually permissible, but they should be treated nevertheless. Again, these facts are particularly true of neurosyphilis.

(For details as to the use of arsphenamine, neoarsphenamine, tryparsamide and the various preparations of mercury, bismuth and the iodides see articles on these drugs in Part II. The text in regard to bismuth is particularly important.)

Sulpharsphenamine may be given by intramuscular injection and, according to Stokes, with little or no pain and with excellent results. (See Sulpharsphenamine.)

It has long been recognized that in the treatment of syphilis the body itself is a most important factor in achieving the results desired. Infection occurring in an individual who is devitalized, from one cause or another, is usually more virulent than it is in one who is in perfect health at the time of inoculation. One of the reasons why patients suffering from this disease often improve more rapidly in a health resort under treatment than they do at home is that all their energies are devoted to the combat instead of being for the most part employed in their ordinary pursuits.

Another phase of this matter deals with the question as to whether in ordinary cases of infection there is not on the part of the body a gradual immunity developed similar in nature to that which we now know exists in infection with tuberculosis. As is well known, a very great number of human beings are infected by the latter disease at some period in their life, but subsequent to infection they develop an immunity which protects them more or less, and sometimes quite completely, from another infection. Evidence is accumulating continually that a similar proposition holds true in regard to syphilis, and it has been thought by some that the latency of syphilitic manifestations after the middle of the secondary stage is an evidence that such a process is taking place in the body. Certain it is, that in some cases of infection in which the virus is unusually virulent and the patient unusually susceptible, these latent periods are comparatively rarely met with.

During this period of rest or quiescence, it has been found that reinoculation does not occur, whereas prior to this a second inoculation is not impossible. Indeed it would appear that natural immunity is more effective in preventing a second inoculation than is the treatment by antisyphilitic remedies, since patients so treated seem to be more frequently subject to such an accident than those who have not been treated.

In this connection it is important to emphasize the fact that very vigorous treatment should be carried out at the earliest possible moment and continued over a long period of time. By this means artificial resistance to the disease may be instituted, whereas slipshod treatment may fail to counteract the infection by arsenical compounds and delay the development of a certain degree of natural immunity. In other words, we not only have the obvious reason for pushing treatment actively as early as possible, but there is a second factor emphasizing this point, which has heretofore not been given sufficient consideration, or to put it differently, a half-hearted line of treatment may be actually harmful not only for the reason just given, but in addition because an immune strain of spirochetes may be developed which it will be most difficult to overcome by any safe dose of arsphenamine.

Another point to be borne in mind is that experimental evidence at the present time indicates that widespread infection occurs at a much earlier date than some persons have heretofore thought likely. The present thought seems to be, that inoculation having taken place, the dissemination of the spirochetes throughout the body takes place almost at once, that is, within a day or two, and that the general infection does not wait until the telltale initial lesion develops.

Finally, in regard to the point as to the necessity of most vigorous treatment in the earliest possible stages of the disease, it is not to be forgotten that after some weeks or months have elapsed the spirochetes are able to imbed themselves in tissues where they are very largely protected from the arsenical compound in sufficient strength to destroy them.

Without any intention of expressing a pessimistic therapeutic view in regard to the efficiency of arsphenamine, it would appear, as additional facts accumulate, that it is a grave question in many cases whether it is possible to consider that a patient once infected is actually cured, in the sense that all infection is eradicated. Warthin has emphasized this point very strongly as a result of his pathological investigations, pointing out that in many instances in which the patient has been thought to be cured, careful examination of the tissues postmortem nevertheless shows the presence of the parasites in a quiescent or a semiquiescent state. (See Arsphenamine, Part II.)

In other words arsphenamine treatment rapidly changes the patient from one who can transmit the disease but unless the treatment covers years it fails to eradicate the parasite completely. To quote Warthin again, syphilitics accorded what has been regarded as thoroughly satisfactory treatment with complete clinical cure, nevertheless at necropsy present latent lesions of the disease.

Clinical results would seem to indicate that the use of arsphenamine immediately after exposure to infection is not efficient, because while it may prevent the development of a chancre, and so lead the physician and patient to the belief that inoculation has not taken place, such a condition has actually occurred and treatment is delayed, when, had the initial lesion developed, the great need of active treatment would have been manifest.

Last of all, it is becoming more and more evident that mercury, while far slower in producing its effects than arsphenamine, has by no means lost its value in the treatment of this disease, and, indeed, may be said to equal or even surpass arsphenamine in usefulness.

In other words, every specific case, unless there is some definite contraindication to it, should receive at weekly intervals, for five or six weeks, a full dose of arsphenamine, or neoarsphenamine, intravenously, and at the end of this period a course of hypodermic or intramuscular injections of some active mercurial. It has been my custom to employ for this purpose ampoules of biniodide of mercury dissolved in physiological salt solution 1 per cent every other day for twelve doses and then to revert again to another course of arsphenamine, impressing upon the patient that this does not complete the treatment, but that it should be repeated at frequent intervals for not less than a year's time, and that this should be done even if an examination of the blood by means of the Wassermann test proves negative. Indeed, it may be said that treatment should be persisted in even if the cerebrospinal fluid as well as the blood produces a negative report. A recognition of the fact that we cannot be sure at present that any method will completely eradicate the infection emphasizes the importance of masterly activity and persistence. It would appear at the present day that the most that we can promise is the submersion of the infection to such a degree that the patient may remain without symptoms, and after a time, partly by natural processes, be unable to transmit the infection.

When a patient is so unfortunate as to return a so-called "Wassermann-fast" test, treatment should be continued for many months without intermission and different arsenicals tried.

Certain it is that the hope of Ehrlich, expressed when arsphenamine was introduced, that in these arsenicals we were provided with an absolute cure, has been dashed on the rocks of disappointment.

For the treatment of late nervous syphilis by drugs see articles on Bismuth, Tryparsamide, Mercury and Iodide of Potassium, in Part II. The treatment of paresis by inoculating the patient with the tertian parasite of malaria is now a well recognized plan. From 2 to 3 cc. of blood from an individual suffering from tertian malaria are injected intravenously or intramuscularly into the paretic. After from one to two weeks the patient suffers from chills and fever and is permitted to have eight to ten attacks. After this quinine is given freely to rid him of malaria. This plan arrests the advance of the paresis in about 50 per cent of selected cases. It is not of service in far advanced cases or those who are so feeble that they cannot withstand the malarial paroxysms.

TETANUS.

Immediately after the receipt of a suspicious wound, the point of infection should be widely incised, washed clean, swabbed with a 3 per cent solution of iodine, and then with peroxide of hydrogen. After this the wound should be loosely packed with gauze wet with iodine solution, and 1500 to 3000 units of tetanus antitoxin should be given hypodermically.

The treatment of tetanus after the symptoms have developed is, so far at least as drugs are concerned and aside from the use of antitetanic serum, virtually identical with that of strychnine poisoning, to which the reader is referred. (See Nux Vomica.) The value of the antitoxin for tetanus depends very largely upon how early it is given. When the disease has once developed it cannot be of much use, but it should always be tried. It may be given in three ways: intravenously, into the cerebrospinal fluid around the spinal cord by intraspinal injection (see Procaine), and intraneurally, as it has been found that the infection travels along the nerve trunk. The intraneural method and the intraspinal injection method are the measures which should be resorted to whenever it is certain that infection by the tetanus bacillus has taken place, and they are particularly needful if the symptoms have already developed. In these cases the point of injection into the nerve should be well above the wounded area to head off the poison, as it travels up the nerve trunk.

Before using antitoxin it is well to test the sensitiveness of the patient by a hypodermic injection of 1 cc. of antitoxin. If no dyspnea or great change in the pulse occurs after the lapse of fifteen minutes give, slowly, 20,000 units intravenously, using the gravity method, through a piece of rubber tubing which is not new, or if new that has been boiled in 5 per cent sodium hydroxide solution. Allowing one-half hour to elapse, give 20,000 units intraspinally. Withdraw about 25 cc. of spinal fluid and warm the antitoxin before using. If spasm prevents puncture relax with nitrite of amyl, followed by a general anesthetic. This treatment is to be daily until recovery ensues, or at least for a week or ten days. Luminal may be used to produce sleep.

A prophylactic subcutaneous and intraneural injection of tetanus antitoxin should always be given when the injury has been produced by the explosion of the toy pistol, as this provides an almost sure preventive of the disease. (See Antitoxin, Part III, and Chloretone, Magnesium Sulphate, Chloral Phenobarbital, and Bromides, Part II.) The diet should be most nourishing. Continuous immersion in hot water may be tried, the skin being protected from maceration by covering its entire surface with benzoinated lard.

TONSILLITIS.

Inflammation of the tonsils occurs in three forms: superficial tonsillitis, in which the mucous membrane covering the tonsils becomes inflamed through extension of a pharyngitis; follicular tonsillitis, in which the follicles are chiefly involved and pour out an excessive secretion, and, finally, true tonsillitis, in which the gland itself suffers from severe, widespread inflammation, phlegmonous in type. In all these forms the treatment to be instituted at the beginning is practically identical. The bowels should be opened by a saline purgative, which in some cases should be preceded by small doses of calomel, the diet should be liquid and nutritious, and a fever and diuretic mixture should be given freely as follows:

℞—Tincturæ aconiti . . . . ♏xl vel lxxx (2.6–5.3)
Spiritus ætheris nitrosi . . . . . . f℥j (30.0)
Liquoris potassii citratis . . q. s. ad f℥iij (90.0).—M.

S.—Dessertspoonful every three hours to a child of ten years; or a tablespoonful (15.0) to an adult.

The best local treatment is to cleanse the tonsil with hydrogen peroxide and then paint it with pure guaiacol on a cotton applicator, or to apply powdered acetylsalicylic acid in the same manner. The first of these applications is very painful for a moment.

Small doses of biniodide of mercury are sometimes useful to abort an attack of acute tonsillitis, $\frac{1}{200}$ grain (0.0003) every hour in water for four or five hours being the amount usually employed.

Externally, an ice-bag should be applied about the throat, and as soon as the purgative has acted and the fever is reduced by the mixture just given, full doses of the tincture of ferric chloride be administered (20 minims [1.3] every three or four hours), in plenty of water, which preferably should be Vichy.

In some instances hot fomentations about the neck and hot gargles seem to be more beneficial than the use of ice. Often a mild antiseptic gargle of phenol (1 to 100) in water will relieve the pain.

Chronic tonsillar enlargement does not require operation as often as is thought. Tonsillectomy is of graver import than appears at first sight. It should be done only by an experienced operator. Because tonsils are chronically enlarged and protruding that does not indicate operation, even if they are ragged. I agree with French, of Brooklyn, who says, "While all extensively diseased tonsils should be enucleated, it is probably safe to say that 80 per cent of enlarged tonsils do not contain foci of infection, and therefore do not need to be completely removed, and, indeed, unless obstructive to voice or respiration, do not need to be removed at all." They should be *removed if they are the seat of septic foci*, even if they are actually out of sight, or if subject to repeated abscess or if they are the cause of cervical adenitis. There are two signs that tonsils should come out: One is a peculiar purple tinge of the mucous membrane of the pillars of the fauces. This nearly always means that the tonsillar tissue is infected by the streptococcus. The other sign is finding enlargement of what may be called the tonsillar lymph node under the angle of the lower jaw. The removal of the tonsils not only relieves local disease but diminishes the danger of arthritic infection and of endocarditis.

The presence of acute tonsillitis as a rule forbids immediate operation as such a course may result in general infection. The time of election is about a week or two after the acute inflammation is past.

As a rule children under six years of age should not have the tonsils removed but washed out, but if the tonsils are distinctly septic they should come out at any age. Within the last few years very competent roentgenologists have reported excellent results from the use of the roentgen-rays in cases in which tonsillectomy is contraindicated.

Quinsy is the name applied to an epitonsillar or peritonsillar abscess. The tonsil rarely suffers from abscess because of free drainage. The epitonsillar form is the more common. When fluctuation develops the abscess may be opened by introducing the closed ends of a pair of scissors above the tonsil by means of which after the opening is made it may be enlarged by separating the blades, or a tenotome, run through a cork so as to prevent its point from puncturing too far, may be employed.

TUBERCULOSIS.

Tuberculosis affecting any part of the body is a manifestation of the fact that vital resistance has been decreased, for if not infection could not have taken place. The whole point at issue in cases of tuberculous infection, as in all infectious, is the building up of vital resistance to such a level that the battle between the invading bacillus and the cells of the body can be waged with victory for the cells, and as soon as they are able to cope with the infecting agent there is at once formed a protecting wall of inflammatory lymph which surrounds the area infected and protects the rest of the body from the bacilli that it contains. The means by which the greatest degree of vital resistance are obtainable is an outdoor life with exposure to as many hours of sunshine as possible and an abundance of fresh air. No drugs can equal the value of these outdoor agencies. (See Climate, Part III.)

The second point to be borne in mind is that no drugs in tuberculosis equal good food if it is well digested and taken in full amount, and he who disorders the digestion by drugs is doing his patient more harm than good. *A good cook is a better friend to a tuberculous patient than a good druggist.* (See Diet, Part III.)

Cases of pulmonary tuberculosis follow, rudely speaking, four well-defined lines. A very early stage sometimes comes to the care of the physician, and it is that in which the following history is given or a similar story is elicited. A patient, previously strong and well or of poor health, as the case may be, begins to lose vivacity. Life becomes a burden and exercise is distasteful. A slight daily chill and fever develop in morning or evening, and the physician who is careless treats the case as one of mild influenza.

Careful examination, however, will show an area in the lung, generally near the apex on one or both sides, where slight prolongation of expiration with a harsh inspiratory sound is heard, and where percussion will give impaired resonance or dulness. In other words, the first stage of tuberculosis is present, and the physician must resort at once to those active measures for the patient's relief which will be considered shortly.

In another form a chill, a sweat, a loss of flesh and vigor, with, more prominent than all, a hard cough, sudden in its onset and rapidly becoming excessive with profuse expectoration, are the dominant symptoms. The wasting is extreme, the sweats are constant, and death may come in a few weeks. This is the form known as "galloping consumption."

The third variety is ushered in by a gradual loss of vigor or a sensation of being a little unwell, or this form is brought before the patient's mind by a sudden acute hemorrhage, or several hemorrhages rapidly succeeding one another. This variety passes along its course with varying rapidity. Death very rarely is due directly to the hemorrhage, although a secondary pneumonia may bring the end. In most cases the disease keeps on for months and the case dies from exhaustion.

Last of all, the fourth class is made up of persons who gradually pass from bad to worse: First, they "catch a cold," which hangs on longer than it ought, and, as soon as they are well, this is followed by another one, which is found more difficult to cure, until finally there is always a cough. Soon wasting comes on, strength is lost, and a long period of months ensues during which the progress of the case is now slow, now fast, the condition now better, now worse, until death ensues from wasting, pneumonia, or some other complication.

These forms and stages have been roughly outlined so that a discussion of their treatment may be taken up with a clear idea of what is to be done.

When a patient exhibits those physical signs which have been given as evidences of the early beginnings of tuberculosis the physician should institute certain hygienic and medicinal measures. If the individual be earning a livelihood by following some confining occupation, this occupation must be given up and one undertaken which is carried on in the open air and yet not accompanied by too great exposure. If the patient is febrile the most important measure is rest in bed. This should be continued until local and general symptoms have abated. No set rule can be given as to the length of time in bed. The rest in bed then should be followed by sitting up, the time being gradually increased and controlled by any tendency to fever. If all goes well graduated walking exercises are permitted. Institutional care has the advantage that a strict regimen can be enforced (See Climate, Part III.) The sleeping-room should be used with all the windows open or if possible a tent life is to be followed.

The medicinal measures to be carried out in all cases of tuberculosis, except that known as the galloping form, are not numerous if we confine ourselves to the modes possessing any real value. For many years cod-liver oil has been sadly abused in the management of these cases, and has been given at all stages, owing to ignorance of its proper use. The writer believes that the following rules are never to be departed from:

1. *Never use cod-liver oil if it disturbs digestion.*
2. *Never use it if fever is active.*

3. *The use of cod-liver oil when rapid degenerative changes are occurring in the lung may be distinctly harmful, as it is not of any service, disorders the digestion, and destroys the appetite.*

4. *Its best employment is in the earliest stages of the disease and in chronic fibroid tuberculosis.*

5. *If the patient can take and assimilate cod-liver oil in addition to plenty of good food give the oil, if not, stop it.*

When the oil is used, it should be given as directed in the article on Cod-liver Oil.

A remedy of some value as a palliative is creosote. Many cures have been claimed from its use in the early stages of phthisis, and it has been highly lauded by a number of European clinicians. In the author's experience it is of value only when the presence of bronchitis requires the use of an expectorant. If it disorders digestion it is harmful. The opinion declared by Strümpell expresses so well the thought which the author was about to write when he read Strümpell's article that his words are here given: "Taking it all in all, we find that creosote, even in large doses, has no injurious effect on tuberculosis. At times we notice an apparently favorable symptomatic effect. We failed, however, to observe any real influence exerted by creosote on the progress of the disease." (See Creosote.) When creosote is used internally it may be given in the following formula:

℞—Creosoti (beechwood)	gtt. xxxij vel f℥j (2.0–4.0)
Tincturæ gentianæ	f℥j (30.0)
Alcoholis	f℥j (30.0)
Vini albi . . . . q. s. ad	f℥iv (120.0).—M.

S.—Teaspoonful (4.0), in water or wine, three times a day.

Better still, creosote may be given in ascending doses (1 minim extra each dose) in milk or wine.

Often a 1-minim (0.06) dose three times a day may be increased to 5 minims (0.3) in the same period with advantage. Sometimes 1 or 2 minims (0.06--0.12) in capsule are as useful as the formula just named. (For methods of administration see Creosote; also, see Guaiacol and Creosote Carbonate.)

Creosote may also be inhaled in the spray from a steam atomizer or by means of an inspirator fitted over the nose and mouth and made of perforated zinc with a sponge at the edge to hold the drug. A very good method is to wet the sponge with creosote, alcohol, and water, equal parts, or to use the creosote alone if coughing is not too severe. Another useful mixture consists of equal parts of terebene, iodide of ethyl, and chloroform. This last mixture is most useful when the secretion is tough and tenacious, and should not be used in the presence of acute irritation due to inflammation. Such inhalers are very cheap, not easily broken, and readily worn. (See Inhalations, Part III.)

If the cough is excessive, a little spirit of chloroform placed on the sponge of the inhaler will often relieve it, or a mixture of morphine and wild-cherry bark may be given as follows:

℞—Morphinæ sulphatis	gr. j vel ij (0.06–0.12)
Syrupi pruni virginianæ	f℥iij (90.0).—M.

S.—Teaspoonful (4.0) every three hours.

Or the following:

℞—Spiritus chloroformi	f℥ss (16.0)
Morphinæ sulphatis	gr. j vel ij (0.06–0.12)
Syrupi pruni virginianæ	f℥iij (90.0).—M.

S.—Teaspoonful (4.0) every four hours.

In still other cases 2 to 10 minims (0.1–0.6) of a good fluidextract of cannabis, or $\frac{1}{8}$ to $\frac{1}{4}$ grain (0.008–0.015) of the solid extract, will act with surprising benefit and stop the cough. Codeine in small doses is also useful when there is an idiosyncrasy to morphine.

Very often during the course of phthisis localized spots of pleuritic inflammation develop which give rise to pain. The best treatment is to apply a small blister or to paint the spot with iodine.

(For the treatment of Hemoptysis see Hemorrhage.)

Laryngeal tuberculosis, one of the most serious complications of this disease, is best prevented by ordering the patient to inhale the steam arising from boiling water which contains corrosive sublimate in the proportion of 1 to 10,000. If a proper watch is kept for evidences of a general mercurial effect, and this measure stopped at once when tenderness of the gums appears, no danger exists. Before the inhalation takes place a spray of cocaine (4 per cent solution) should be thoroughly used.

The main treatment of laryngeal tuberculosis is absolute vocal rest. A method of value is that of iodoform insufflations. A powder of iodoform alone is too light for satisfactory propulsion into the larynx, and powdered talc should be added to it in small amount, with $\frac{1}{16}$ grain (0.004) of morphine to each dram (4.0) of iodoform. The odor is generally disagreeable to the patient, but if a cocaine spray be first applied to the fauces and the operator is skilful, very little coughing is produced. As iodoform is a local anesthetic, it relieves the pain in the larynx, acts as an antiseptic and alterative, and is peculiarly obnoxious to Bacillus tuberculosis.

Camphoric acid in 20- to 30-grain (1.3–2.0) doses is the best internal remedy for treating night-sweats. (See Camphoric Acid.)

When the night-sweats are very profuse, hypodermic injections of atropine in the dose of $\frac{1}{150}$ to $\frac{1}{100}$ grain (0.0004–0.0006) are useful in some cases, and the efficiency of this treatment may be increased by the use of an alum sponge-bath at bedtime. A solution of alum, 10 to 20 grains to 1 ounce (0.6–1.3 to 30.0), may be sponged over the body, or sulphuric acid may be added to water in the proportion of 1 dram to 1 pint (4.0–480 cc.), and used in the same way as the alum solution. Formaldehyde solutions may also be used.

Sulphuric acid is often given internally with advantage in these cases of sweating.

Reference should be made to the treatment of pulmonary tuberculosis by *artificial pneumothorax*. This method is based on the view that the collapse and consequent rest of the lung will aid in arresting the process. It is applicable only in those cases in which the lesions are almost solely on one side, since it is necessary that the lung not compressed shall compensate for the work of the collapsed lung, and that there shall not be pleural adhesions which cause the lung to adhere to the chest wall. For these reasons both sides of the chest should be carefully studied by the aid of the roentgen-rays before instituting the procedure, and if the roentgen-rays reveal the position of one or more cavities to be such as to prevent drainage into a bronchus the operation is contraindicated because septic absorption will ensue. The fact that the disease on one side is very far advanced does not contraindicate this plan. Indeed, some of the best results have been obtained in cases so far gone that any method was acceptable to the patient.

Matson, Matson and Bisaillon in a communication, based on a very large experience, to the *Twentieth Annual Meeting of the National Tuberculosis Association* in 1924, stated that a classification of the status of the contralateral lung is necessary if accurate deductions based upon end-results are to be made. The following summary on this subject is so well presented by them that I quote it.

"The end-results of pneumothorax therapy are less dependent upon the status of the contralateral lung than they are upon the character of collapse and type of disease in the worse diseased lung.

"The various types of contralateral lung lesions vary greatly in their prognostic significance.

"Fibrocaseous infiltrations involving the upper portion of the lung offer a more favorable prognosis than the bronchogenic extensions into the lower portions of the lung.

"The mere presence of disease in the contralateral lung does not contraindicate collapse of the worse diseased side.

"Rales in contralateral lung disease must be carefully studied in order to determine their pathological significance.

"The absence of râles in a diseased contralateral lung by no means indicates absence of activity.

"Cavity cases with abundant expectoration should be subjected to early pneumothorax treatment in order to prevent aspiration infection of opposite lung.

"Very active contralateral lung disease should be allowed to subside before instituting pneumothorax on worse diseased side.

"In the presence of contralateral lung disease great caution should prevail in collapse of the worse diseased lung.

"In some cases, the worse diseased lung should be held merely separated from the chest wall pending observation of the behavior of the contralateral lung.

"Flexibility or rigidity of the mediastinum plays an important role in behavior of contralateral lung during collapse.

"Excellent results are occasionally attained by cautious collapse even in the presence of extensive contralateral lung disease.

"Satisfactory end-results are frequently proportionate to the degree of watchfulness accorded the contralateral lung.

"The status of the contralateral lung should be observed by frequent physical and roentgenological examination and accurate records should always be maintained.

"Ausculatory phenomena transmitted from the worse diseased to the contralateral lung should be differentiated from those findings due to active disease in the contralateral lung.

"The contralateral lung should always be suspected when unfavorable clinical symptoms arise."

The object of inducing pneumothorax is to secure a selective collapse of the diseased part of the lung. The negative pleural pressure is lessened, but not to the point where it equals the intrapulmonary pressure. The result is that the involved part of the lung is collapsed but not compressed, and it continues to function to a limited extent in respiration, although the diseased part is rendered airless and fixed (selective collapse). Much harm may be done by the injection of air to the point where the intrapleural pressure exceeds the intrapulmonary pressure. Pressure on the mediastinal structures, embarrassment of the pulmonary circulation, interference with drainage from cavities, and many other untoward effects result from inflation under positive pressure.

If the pneumothorax is properly induced the method is not very dangerous, but cases of pleural shock and pleural effusion as sequences have been reported. Neurotic and lymphatic patients and those advanced in years or very young are less favorable subjects than others.

The results which accrue usually consist in prompt diminution of cough and expectoration and a decrease in the systemic manifestations of the disease. So, too, it has been found a most efficient means of arresting profuse pulmonary hemorrhage. If the other lung is in fairly good condition there is little dyspnea.

Before introducing the needle into the pleural cavity it is usually wise to use infiltration anesthesia in the skin, the subcutaneous tissues and the parietal pleura. In many instances it is entirely proper to use the small needle used to produce infiltration anesthesia for the puncture.

Several methods of introducing the air are resorted to. The simplest consists in introducing a small aspirating needle, preferably in the fifth or sixth intercostal space, in the mid-axillary line or anywhere the pleura is free, the patient lying on the unaffected side. Through this needle air is slowly passed to the extent of from 200 to 300 cc., but it is not so much a question of the amount of gas as of the pressure exercised. The manometer should be read after the injection of each 25 to 50 cc. of air. The lung should not be compressed by a very large single injection except when it is necessary to control hemoptysis. (See below.) About this quantity is injected on alternate days until satisfactory collapse of the lung is gradually induced. The degree of collapse should be estimated not only by ordinary methods of physical diagnosis but by the aid of the roentgen-rays. The negative pressure fluctuations caused by respiration should equal about 10 mm. or more of displacement in the manometer. If such fluctuations do not occur the injection is contraindicated, since their absence indicates that the lung is bound to the chest wall by adhesions and cannot be made to collapse.

Repeated injections must be made to maintain the collapse. This is the whole point in the treatment. To repeatedly collapse the lung and then let it expand is harmful. The fluoroscope is a valuable aid when available to determine the degree of collapse and as a guide to refills.

As a rule the collapse must be continued many months before the lung heals in its collapsed form. Often when the treatment is stopped after some months, and when the patient is so greatly improved that it is thought wise to stop, the lung will expand slightly.

Finally, it is manifest that the most rigid rules of asepsis must be constantly adhered to, as a pyopneumothorax may readily be induced through errors in the technique.

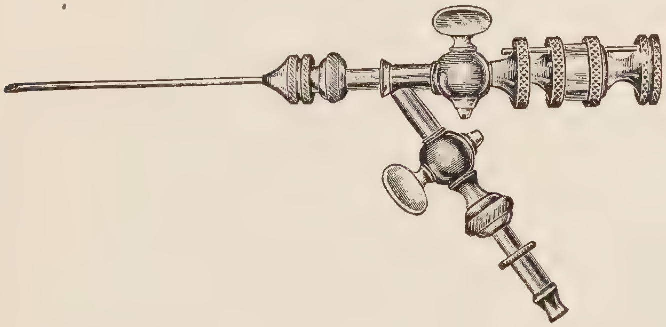

Fig. 143.—Floyd's modification of Brauer's needle for use in pneumothorax therapy.

The outstanding features of one type of apparatus (Figs. 143 and 144), are its simplicity of design and the convenience with which it may be used. The entire apparatus, except the pump and the needle, is either permanently attached to or inside the glass container. It is ready for use without any preparatory assembly.

Air is compressed in the bottle by means of the hand pump and a mercury manometer with two scales shows (1) the pressure in millimeters of Hg and (2) the discharge of air in cubic centimeters.

Air is delivered to the thorax by means of a special needle with indicating valve and auxiliary escape port.

At any time during the inflation the chest pressure may be determined by turning the valve H into the horizontal position, when the pressure in cms. of water will be indicated on the scale shown at the left.

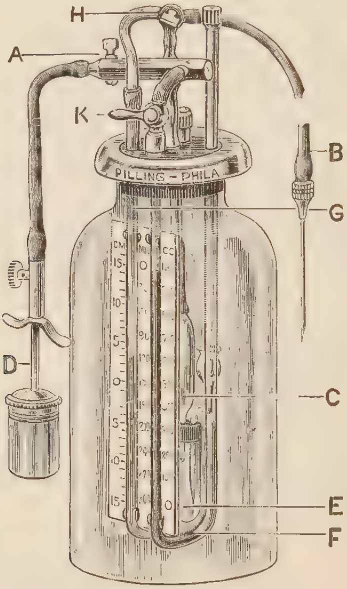

Fig. 144.—Loving's pressure pneumothorax apparatus.

All air is passed through a 5 per cent phenol solution and a cotton filter.

Valve A is closed except when pumping and valve H is opened at the beginning and closed at the end of use, leaving only valve K to be operated during the procedure—a measure of its simplicity.

The apparatus may be mounted on a wood base with backboard and a substantial cabinet-made case carries the entire outfit set up and ready for use. With valve H in the horizontal position and valve K closed, the apparatus may be inverted without spilling contents of either manometer.

It need hardly be added that this plan is to be instituted in a well selected class of cases, as, for example, the patients who have unilateral, chronic fibrocaseous tuberculosis without adhesions and those in which the cough is exhausting, hemoptysis is repeated or dangerous in amount, and the lung is suffering from fairly widespread and advanced lesions which are tending to break down and form cavities. For obvious reasons the last named patient offers the least chance of betterment.

Tuberculosis of other parts of the body than the lungs may be treated by remedies already suggested but their management is often surgical. In peritoneal tuberculosis with much fluid in the abdomen one or more drainings by the trocar and cannula give relief but usually a cure is affected if the abdomen is opened so that air enters and is then closed. This is useless in the scaphoid abdomen of this disease, in the presence of tuberculomata, and in tuberculosis of the intestine and appendix. In these cases a colostomy or other procedure may be necessary. When generalized adhesions are present operation is useless and harmful.

Very remarkable results in all types of tuberculosis are now obtained by heliotherapy. (See Heliotherapy, Part III.)

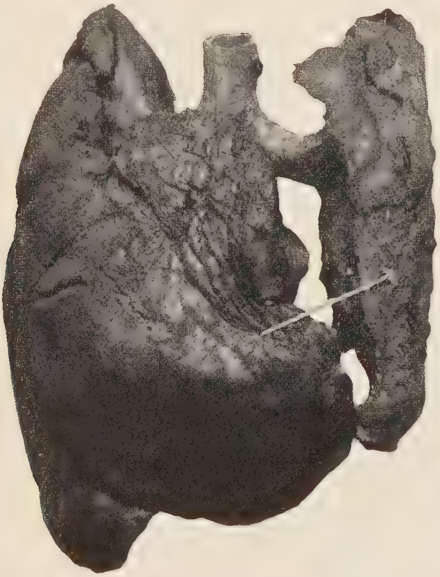

Fig. 145.—Showing the degree to which the left lung may be collapsed by artificial pneumothorax within nineteen days. (Amrein and Lichtenhelm.)

TYPHOID FEVER.

Any attempt to review the various forms of treatment of the disease known as typhoid fever is absolutely impossible, owing to the very numerous theories and practices put forward by various clinicians. What is said under the general heading of Fever and under the consideration of Cold, Part III, and also under Antipyrine and Acetanilid, gives sufficient information as to the treatment of febrile movements, and the care of the patient beyond this point in nearly all cases depends upon the severity of the attack.

Before going farther, however, the writer desires to insist very strongly upon one fact—namely, that a case of typhoid fever is not curable in any degree. No remedy yet found, except it act through the prevention of complications, can shorten the course of the disease. We can only guide the patient safely to health when the storm of disease comes on, and we cannot stop the storm.

Not only should the facts of the last paragraph be carefully borne in mind, but the physician must also remember that he is treating an exhausting disease—not a disease which runs a violent course for a few days and strands the patient sick and weak, but convalescent, upon the shores of health, but one in which, after sapping the strength for weeks, some sudden intercurrent malady or accident may ensue which will speedily kill him if every grain of strength is not preserved for the struggle. The physician should always put every case in which there is a suspicion of typhoid fever to bed at once, and keep the patient there until the disease has passed or fails to develop. Every muscular movement unnecessarily made is a waste of force, and, in consequence, everything should be done for the patient, and not by him. A bed-pan should always be employed, the patient not being allowed to sit erect upon a commode.

Remembering, too, that a typhoid fever patient is subjected to prolonged wasting fever and toxemia for many days, his nutrition should be maintained by the use of a nourishing diet easy of digestion. In addition to milk he should also receive 1 or 2 soft-boiled eggs each day, arrowroot and perhaps thin corn starch, provided they agree with his digestive powers. If diarrhea is not present, broths may be given, but it must be recalled that Brieger has shown that typhoid bacilli do not readily reproduce themselves and their poisons in peptonized or well-digested milk, but do so very actively in meat-broths or jelly which has not been acted upon by the digestive juices. Milk diet is therefore evidently better than a broth diet in typhoid fever, and we once more are able to explain an empirical fact by a scientific discovery. There is no reason for using liquid instead of solid foods, except the difficulty of digesting the latter. (See next page.)

Alcohol has been used in all stages of typhoid fever as a stimulant, as a giver of force to the system, and as an aid to digestion, but its real value is found when actual depression exists. A very large part of the profession believe that the mere presence of an abnormally high temperature contraindicates the use of alcohol. Mere high temperature does not do so, however. High temperature of a sthenic type, with a full, tense, bounding pulse and all the signs of a disease attacking one in the full vigor of life, may preclude its use; but in the high temperature of advanced typhoid, with the marked asthenia often present in that stage, alcohol should be given whenever the heart sounds are feeble. Under these circumstances the tissues which the man can afford to lose are gone, and much of his vitality is greatly encroached upon: the alcohol yields force to the body, and is burnt up in great part, keeping the flagging heart pumping the blood through the lungs and systemic circulation, when otherwise the circulatory depression would result in hypostatic congestions, if not in more widespread circulatory disorder. Alcohol acts rather by restoring the equilibrium of the circulation and giving force to the body than by a direct stimulant effect. It may also increase the bacteriolytic power of the blood. In those cases in which a temporary loss of heart power is due to hemorrhage or to some sudden severe depression, alcohol is one of the remedies to be employed—in a hot and concentrated form. (See Alcohol.)

A no less useful and valuable result obtained by the use of alcohol in the later stages of exhaustive fevers is the part that it plays in aiding digestion. The writer has elsewhere defined the difference between the influence of alcohol in the artificial digestion of the test-tube and that occurring in the stomach. Aside from experimental evidence, every-day experience has taught the *gourmand* that alcohol, in a fairly concentrated form, enables him to digest an amount of food which under ordinary circumstances would remain unchanged in his stomach.

The physician ought not to use alcohol as a routine measure in every case without a rational idea of why he does so, nor without a clear idea as to what indication is met by its use. In many cases it is not needed at any time.

That alcohol may be misused and cause great harm is, of course, known to every practitioner of medicine. So long as it reduces the temperature and lowers the rate of the pulse, causes a moist skin and tongue, and quiets nervous twitchings, it does good, and only up to this point is it to be employed.

The treatment which is used by the author for many years in his wards at the Jefferson Medical College Hospital has given him results which the application of other methods has failed to give, and is as follows:

As soon as the patient enters the house he is washed or bathed and placed in bed, and required to remain there. He is assured that the more quietly he lies the more mild and safe will be the course of his attack, and is made to use a bed-pan and urinal, and never allowed to get up. He receives several small doses of calomel, followed, if the bowels are not moved, by a mild saline purge, such as a Seidlitz powder.

Whenever the temperature reaches 102° F. he is given cold sponging with friction or an ice rub. This is essential. (See Cold, Part III.)

I am one of those who are firmly convinced that for many years we have been making a grave mistake in confining patients suffering from typhoid fever to a purely milk diet. We must recollect that the average adult requires at least 2500 Calories a day for normal existence, and as each quart of milk represents only about 500 to

600 Calories, it is evident that for a patient to receive the total number of calories required for the maintenance of his body he must drink not less than $4\frac{1}{2}$ quarts of milk a day. These facts further impress us with the utter inadequacy of the pure milk diet in this disease. Nor can we help appreciating the fact that we are overloading the organs of absorption and elimination with an excess of fluid, which certainly cannot be advantageous, although of course an excess of liquid in typhoid fever is preferable to a lack of it.

In some instances, milk agrees with the patient if it is partly diluted with plain soda-water, Vichy or White Rock water.

Again, I can see nothing in the clinical history or pathology of this disease which in any way justifies us in disordering metabolism by the institution of a rigid milk diet.

It is my custom to give all patients, after the first week of typhoid, from 1 to 2 soft-boiled eggs a day in addition to the ordinary allowance of milk, and to vary their diet by the use of curds and whey, rice which has been boiled to a pulp, barley, and wheat gruel, and a cup of corn starch with vanilla or some other flavoring substance of a like character. As a result I very rarely see the marked ataxia which is so common a symptom in convalescence from the typhoid fever. The patient's nutrition is so well preserved that he is but little more emaciated than many cases of acute pneumonia at the time of recovery. Secondary complications like furuncles and bed-sores are almost unknown, for by the use of a plentiful supply of food the patient's vital resistance is maintained to such a degree that simultaneous collateral infections do not take place. The average case of convalescent typhoid fever is a fair mark for any infection because it is half-starved.

Recognizing that typhoid fever is characterized by a deficient secretion of digestive juices, all these patients receive hydrochloric acid and pepsin when proteids are administered, and taka-diastase or pancreatin when carbohydrates are used.

For the dry and sordes-covered tongue a mouth-wash of glycerin and water, half and half, to which may be added a little lemon-juice, is used, and it is important to keep the mouth constantly cleansed, as by this means swallowing is not interfered with through cracking of the lips, tongue, and buccal mucous membrane, pulmonary infection is avoided, and facial erysipelas and parotitis are prevented.

If constipation is very obstinate and continues over one day, an injection is employed, and if this, after being used twice, fails to act, a dose of calomel, $\frac{1}{6}$ grain (0.001) every fifteen minutes until 1 grain has been taken, is prescribed, and, if no movement occurs in twelve hours, is followed by $\frac{1}{2}$ bottle of citrate of magnesium, or 1 teaspoonful of liquorice powder is given. In other cases small doses of cascara sagrada are equally useful. Violent purgatives should never be used, for obvious reasons. Rectal injections should be given some hours after the purgative is taken, to aid its action, since not infrequently the laxative causes the contents of the small intestine to flow into the large bowel, which is too inactive to extrude them.

When diarrhea becomes troublesome—that is, more than three or four passages a day—the following will be of service:

℞—Acidi sulphurici aromatici	f ʒij (8.0)
Fluidextracti hæmatoxyli	f ʒiij (12.0)
Syrupi zingiberis	f ℥iij (90.0).—M.

S.—Teaspoonful (4.0) in water every hour until relieved.

Should the stools be excessively fetid and tympanites be marked, guaiacol carbonate or phenolsulphonate of sodium may be given as an intestinal antiseptic, or, as soon as any evidence of tympanites or much meteorism comes on, turpentine may be given, as follows:

℞—Olei terebinthinæ	f ʒij (8.0)
Syrupi acaciæ	q. s. ad f ℥iij (90.0).—M.

Fiat emulsum.
S.—Teaspoonful (4.0) in milk three times a day.

At the same time it is well to employ a turpentine stupe over the abdomen. (See Turpentine.) Where the tympanites is marked it may be relieved by an injection made as follows:

℞—Olei terebinthinæ	f ʒj to ʒij (4.0–8.0)
Olei olivæ	f ℥iv (120.0)
Emulsi asafœtidæ	Oj (480 cc).—M.

S.—Use as an injection. Shake well before using.

When the tympanites is severe, ½ ounce (16.0) of Hoffmann's anodyne may be used in place of the turpentine, or alum, 1 ounce to 1 quart of water.

In the later stages of typhoid fever, as convalescence is approached, turpentine given internally is often useful, as it seems to cause rapid healing of the intestinal ulcers and checks diarrhea.

Much has been said about the value of purgatives and so-called intestinal antiseptics in typhoid fever, and extravagant claims made for them. Suffice it to state that while they may be indicated in certain cases they are not to be used as a routine plan of treatment, because the skill of the true physician is to give each patient what he needs—not to give all the same treatment. Typhoid fever cannot be aborted; it can only be modified in the sense that we place our patients in the best possible physical state to withstand its ravages. I never employ either plan.

A point of importance in the treatment of typhoid fever is to see that the patient receives enough water in twenty-four hours. Owing to his apathy he often does not complain of thirst and the kidneys are not flushed of impurities by fluid. Some perfectly pure water, such as Poland water, should be freely given to help eliminate toxic materials through the kidneys. Should toxemia be severe, the use of cold is essential, and if in addition emaciation be marked, it is wise to employ enteroclysis. (See Part III.)

Not infrequently cases are met with in which toxemia with mental depression is well developed, yet in which the temperature is below 102° F., and so the use of cold sponging seems contraindicated. Active friction with tepid water and alcohol is now of value. If the temperature is normal or subnormal, the patient may be sponged with hot water. The value of this measure does not lie so much in the temperature of the water as in the reaction and consequent readjustment of the circulation.

As during the later days of the disease and in convalescence a large number of typhoid bacilli are in the urine, the routine use of urotropin or uritone, as a urinary antiseptic, is resorted to by many physicians. It may also be used to prevent cholecystitis arising from this infection and to prevent the spread of the disease by the dejections of so-called "typhoid carriers." (See Hexamethylenamine.)

The *complications* of typhoid fever of the most serious import are hemorrhage from the bowel, pneumonia and pleurisy, and perforation of the bowel.

The hemorrhage from the bowel may be treated as indicated under that heading (see Hemorrhage), and the pneumonia or pleurisy should be treated as are these diseases when they occur alone; but it is to be remembered that the patient is an *asthenic adynamic case*, and must not be *depressed* and may need *stimulation*.

When perforation of the intestine occurs, only enough morphine should be given to relieve agony. Warm applications should be used over the belly and down the limbs, and stimulants given if needed. In all cases where it is possible to find a surgeon capable of doing a skilful abdominal section, a consultation should be had at once. As a rule, the operation should be performed immediately.[1] (See Shock.)

As stated at the beginning of this article, cold bathing is very important and should always be employed in one of its forms if the fever is high, except in the presence of pneumonia, hemorrhage, or perforation, provided the patient reacts.

For a number of days after the patient begs for solid food it should not be allowed, for he will ask for it long before he should have it; but if the temperature remains normal after seven days, solid food may be used and the patient gradually brought back to an ordinary simple diet.

UREMIA.

The treatment of this dangerous manifestation of renal disease is often futile, but always to be resorted to with the recollection that wonderful recoveries sometimes occur under judicious management.

Uremia is a symptom complex not a disease. The cause or causes are still unknown. Different types are probably due to various causes or a single cause. The condition is undoubtedly an intoxication. It appears chiefly in three forms. The convulsive type, often sudden in onset, has a relatively low mortality. In this type amblyopia is often present. This type is probably not entirely renal in origin but largely due to disorder of the liver. If venous congestion is marked or the blood-pressure is high, the patient should be bled and dextrose and insulin given to store the liver with glycogen. (See Dextrose and Insulin, Part II.)

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[1] For discussion of this condition see the author's work on the Medical Complications and Sequelæ of Typhoid Fever. Lea & Febiger, Philadelphia, second edition, 1909.

In cases manifesting marked dyspnea, unless venous congestion is severe, there is a tendency to acidosis, caused, not by ketone bodies, but by retention of acid sodium phosphate and the urgent breathing is an effort to get rid of carbon dioxide which is not carried freely to the lungs by combining with the sodium carbonate in the blood. Such cases need the free use of sodium bicarbonate by mouth or by vein.

In still another type of case there is drowsiness or stupor often preceded by neuralgia, or general headache, with impaired vision. Sometimes there is monoplegia or hemiplegia. In such instances there is often transudation of blood or lymph from the cerebral vessels. If the blood-pressure is high, spinal puncture is very useful in this type to relieve intracranial pressure, or a brisk purgation by elaterium, or elatrin, in the dose of $\frac{1}{6}$ grain (0.01) or $\frac{1}{16}$ grain (0.004) respectively. The elaterin may be dissolved in a few drops of alcohol or whisky or given in pill. In other cases 1 ounce (30.0) of Epsom salt in 6 ounces (180.0) of hot water may be used.

Although for ease of description these types of uremia are described separately there is in practice often no sharp line which separates them in a given case. For this reason the following measures may be called for in certain patients.

In every case of uremia the blood-pressure should be taken and an estimate made of the strength of the heart muscle by a study of its first sound and the vigor of the pulse.

Aromatic spirits of ammonia and Hoffmann's Anodyne are valuable if the heart is weak, and are to be followed by strychnine and digitalis if necessary.

For the support of the heart if it is feeble we employ strychnine hypodermically or by the mouth in the dose of $\frac{1}{20}$ to $\frac{1}{10}$ grain (0.003–0.006), and follow it by the more powerful stimulant digitalis in the dose of 30 minims (2.0) of the tincture by the mouth. Hypodermic injections of ether are also very valuable if the tissues are not too edematous for absorption to occur.

Should pulmonary edema threaten, atropine may be given in full dose with advantage and dry cups should be placed over the bases of both lungs.

The convulsions, if present or threatened, are to be combated by the use, after the bowels have been washed out, of an enema of 20 grains of chloral (1.3) and 60 grains (4.0) of bromide of sodium in 3 ounces (90.0) of starch-water, and the hot pack will also be of value, not only to produce sweating, but for its sedative influence on the nervous system. Should the convulsions be severe amyl nitrite inhalations may be employed until the chloral and bromide can be absorbed. In other instances morphine is to be freely used.

In acute glomerular nephritis producing headache, vomiting and sometimes convulsions, associated with high blood-pressure a hypertonic solution of sodium chloride may be given intravenously to relieve cerebral pressure resulting from edema of the brain. (See Intravenous Injections.) In place of ordinary salt a 1 per cent solution of magnesium sulphate may be injected giving 10 to 20 cc. of the fluid to each kilogram (roughly 2 pounds) of body weight not faster than 2 cc. per minute. This causes a prompt fall in blood-pressure. It is safer than spinal puncture in that there is less danger of draining off so much fluid that the brain rests upon the base of the skull or is even pushed into the foramen magnum.

Venesection is contraindicated in the feeble, but as much as 1 to 2 pints (480–960) of blood may be withdrawn in a sthenic case from a vein in the arm. (See Part III.) After the bloodletting or during its progress hypodermoclysis may be performed or a saline solution injected into a vein. (See Intravenous Injection.) Often deep insensibility is speedily removed by venesection which should be regarded as the sheet-anchor of treatment in those cases which have venous turgescence. Bleeding and the use of salt solution are usually best suited to the uremia of chronic contracted kidney. In parenchymatous nephritis anuria is often present, but a tendency to transudation from the bloodvessels into the lungs and general tissues is commonly met with, and for this hypodermoclysis is unwise and intravenous injection dangerous. (For Treatment of Eclampsia see Puerperal Diseases, Part IV.)

VITREOUS DISEASES.

Vitreous opacities may be either dust-like, flaky or dense and membranous. They impair vision in proportion to their number and density, and are readily seen with the ophthalmoscope. Patients observe them as floating dark spots in their field of vision, because the opacities cast a shadow upon the retina. If vitreous disease is syphilitic the usual remedies are indicated. Hypodermic injections of pilocarpine or sweating by the electric cabinet act favorably. Galvanism has been recommended. Often opacities are due to uveitis, choroiditis and chorio-retinitis, and these diseases must be treated according to their causation.

VOMITING.

Vomiting is a symptom, not a disease, and arises from a large number of causes, some of which are very unimportant, others very serious. The most common cause is probably imperfect digestion, with all that this implies; that is, gastro-intestinal irritation and perversion of normal function. Additional causes are cerebral hemorrhage, tuberculous meningitis, cerebritis, uremia, or diseases of the middle lobe of the cerebellum, all of which conditions cause irritation of the vomiting center.[1] In children it is occasionally due to a disorder of metabolism which results in a state characterized by acidosis as in so-called cyclic vomiting and in cholera infantum.

Some of these states may be considered as lesions of a centric character which directly or indirectly cause the vomiting center to send out impulses. On the other hand, it is worthy of note that under certain circumstances vomiting may be reflex and dependent upon irritation of the nerves of the stomach or elsewhere which convey impulses to the center and the muscles whose activity results in vomiting. These conditions are well represented by the vomiting which comes on in incarcerated hernia, or in pregnancy, or in that occurring during the passage of renal or hepatic calculi, or in indigestion.

It is important to bear in mind that peripheral vomiting due to disorder of the gastric walls may be dependent upon two conditions. The mucous membrane and its nerves may be overexcitable or they may be depressed. For this reason we shall find that two modes of treatment are necessary when this subject is considered below.

The mechanism of vomiting consists in the closure of the pyloric sphincter, the contraction of the gastric muscles from the pylorus to the cardia, and at the same time, and more important than these movements, the contraction of the supplementary respiratory and abdominal muscles, which so compress the stomach as to drive its contents through the open esophagus. The violence of the muscular contractions in the abdominal walls is greatest when the stomach is partly empty, and gives rise to the pain and exhaustion accompanying the condition known as retching. The practical point to be learned from this is that vomiting is always easier when the stomach is not empty; so if an emetic is to be given on an empty stomach, as the popular expression runs, a large amount of liquid should preceed or accompany it if possible. Dogs vomit easily because of the development of their gastric muscles, but they render the effort easier by filling the stomach with air or grass, and so completely fill the viscus that its walls can contract on a resisting mass.

Having described the mode and causes of vomiting, it remains to consider its treatment.

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[1] See Symptoms in the Diagnosis of Disease, by the author. Lea & Febiger, Philadelphia.

It is needless to remark that the vomiting of cerebral disease is very intractable, and that very active agents must be used to check it. The vomiting following etherization is often centric, and should be treated, as should all forms of obstinate emesis by the injection into the rectum of 40 grains (2.4) of sodium or potassium bromide and 20 minims (1.2) of tincture of opium in 4 to 8 ounces (120.0–240.0) of starch-water. If this does not check the vomiting; a second injection may be given two hours after the first. A very valuable remedy in this state is acetanilid given in 1-grain (0.06) doses every half hour in 1 dram of brandy with cracked ice (see Acetanilid), and it is well to remember that inhalation of the fumes of vinegar from a cloth wetted with it will often be of service. In other cases relief is obtained by washing out the stomach, and this is essential if the stomach is distended.

When vomiting seems to be due to hyperexcitability of the gastric mucous membrane, so that very small amounts of food when swallowed are at once rejected, local anesthetics and depressants are needed, the chief of these being chloretone or cocaine. When given as antiemetics, these drugs act as local anesthetics, or, in other words, by paralyzing the peripheral sensory nerves of the stomach. Cocaine is best given in capsule so as to exert all its effects on the stomach rather than on the mouth and esophagus.

Two grains of chloretone given in capsule or dissolved in a little brandy and poured over cracked ice and given in very small doses are useful. This treatment may be repeated every hour for five doses, and is very efficient.

Sometimes a prescription of the following character is of service, the bismuth acting as a coating to the walls of the stomach, protecting and soothing them:

℞—Bismuthi subnitratis	ʒiij (12.0)
Acetanilid	gr. xx (1.3).—M.

Fiant chartulas, No. x.
S.—One powder every half-hour.

In other cases of the same type the following is useful, and is to be preferred if, owing to active fermentation, the vomiting is excessive (the creosote or phenol being a local anesthetic and antiseptic):

℞—Phenolis vel creosoti (beechwood)	gtt. x vel xx (0.6–1.3)
Bismuthi subnitratis	ʒiij (12.0).—M.

Fiant chartulas, No. x.
S.—One powder every hour.

In other cases 1 drop of tincture of iodine and 1 drop of phenol in a couple of drams of water will act very well.

Sometimes pure chloroform in 1- or 2-drop (0.06–0.1) doses, in a little water, does good; and dilute hydrocyanic acid, in the dose of 2 to 4 minims (0.1–0.3) is also of value in like instances, given in 1 tablespoonful (15.0) of water.

In other instances small repeated doses of nitroglycerin do good.

Particularly is nitroglycerin useful in the nausea which often follows the use of opium, although this symptom is best prevented by its preliminary use. The dose used should be about $\frac{1}{300}$ grain (0.0002) every half-hour.

The treatment of a case of vomiting dependent rather upon depression and debility of the stomach than upon irritation is directed to the administration of gastric and, it may be, systemic stimulants. The chief of the gastric stimulants is ipecac in small doses, and it is this employment of a drug generally resorted to for the production of emesis by physicians which has caused homœopaths to claim that the regular school obey the rule of *similia similibus curantur* and infinitesimal dose. The claim only holds good on its face, for we do not use an infinitesimal dose, and obey no law, but use common sense. Ipecac is an irritant, even to the skin, and it is partly by its irritant effects in large doses that it causes vomiting by exciting the stomach to a point over and above its normal condition. In the vomiting depending upon gastric debility and depression small doses of ipecac do good because they irritate the stomach sufficiently to restore its normal tone without going to the other extreme of hyperexcitation. Under these circumstances a drop dose of the wine of ipecac, or $\frac{1}{4}$ grain (0.015) of the powdered ipecac, every hour, is of the greatest value, often succeeding after all other remedies have failed.

In other instances tincture of nux vomica, given in $\frac{1}{2}$- to 1-minim (0.03–0.06) doses, is useful as follows:

℞—Tincturæ nucis vomicæ . . . . gtt. iv *vel* viij (0.25–0.5)
Aquæ cinnamomi . . . . f℥j (30.0).—M.
S.—Teaspoonful (4.0) every half-hour or later.

In the nausea and vomiting following an alcoholic debauch $\frac{1}{2}$ to 1 minim (0.03–0.06) of Fowler's solution every two hours, or before food, often gives relief, and it may be used in some cases in place of the nux vomica and ipecac. Another useful measure for the cure of alcoholic nausea if the tongue is heavily coated is the use of full doses of hydrochloric acid, 5, 10, or 15 minims (0.3–0.6–1.0) of the dilute acid in $\frac{1}{2}$ a tumblerful of water, repeated every two hours.

In all cases of persistent vomiting counterirritation should be applied over the stomach in the form of a mustard-plaster, or, if preferred, an ice-bag may be applied to the nape of the neck, the lumbar spine, or the epigastrium.

The food given in cases of vomiting should be especially prepared. It is always best to use peptonized milk, made by using the peptonizing materials sold by several reliable drug firms. (See Diet, Part III.) Citrate of sodium should always be put in the milk if it is not peptonized. If lime-water is used the small amount usually employed is perfectly useless, at least 2 to 3 tablespoonfuls (30.0 45.0) should be placed in each glass of milk.

Another point of importance is the quantity of liquid taken. As fast as the patient vomits he is often fed with glasses full of liquid by well-meaning friends. Instead of this, he should have only 1 or 2 teaspoonfuls (4.0–8.0) of milk every hour, half-hour, or fifteen minutes, for it is better for him to retain a dram than to take a quart and vomit it. Often milk will disagree with the patient, and then he may be given with excellent result barley gruel, which has been strained, and follow it by 3 grains (0.2) of taka-diastase or 1 dram (4.0) of liquid taka-diastase. In its place strained gruel made from wheaten grits, oatmeal, or rice may also be used.

When the vomiting of pregnancy becomes pernicious in type the only cure is emptying of the uterus. Moderate types can be benefited sometimes by sodium bicarbonate or levulose. (See Dextrose and Corpus Luteum, Part II, also Puerperal Diseases.)

In the cyclic or toxemic vomiting of childhood eggs are to be forbidden and dextrose in solution given by the rectum by the drop method, as this state is akin to diabetic coma. If the rectum is not retentive 100 to 200 cc. of a 5 per cent solution of dextose may be given intravenously (see Intravenous Injections) with 1 unit of insulin hypodermically for each 2 or 3 grams of dextose injected, to aid in its utilization. (See Dextrose.) It is most essential that all fats be excluded from the diet, and in some cases all milk. Chocolate is forbidden. So, too, it not infrequently happens in the severe diarrhea of early childhood that the body turns upon its fats for energy and oxybutyric acid is produced, causing so-called acidosis. Usually the child will have hurried respirations and a tendency to stupor. (See Dextrose and Insulin, Part II.) Under these conditions bicarbonate of sodium should be given freely in solution by the mouth and by the Murphy drip. As much as 1 ounce of the soda in twenty-four hours being used, in the strength of 2 drams to 8 ounces (8.0–350) of water, if possible. As a rule a little child will not tolerate a Murphy drip faster than 10 drops every minute. When the condition is urgent, sodium bicarbonate solution should be given intravenously in the strength of 4 per cent or by hypodermoclysis in the proportion of 2 per cent and continued until the urine is made alkaline. If bicarbonate of sodium is used by hypodermoclysis the solution must not be boiled, as it will be changed into the irritating sodium carbonate and cause a slough. In children as young as twelve months as much of the bicarbonate may be used as 2 drams (8.0) in twenty-four hours.

WHOOPING COUGH.

The remedies recommended for this disease are numerous and every one of them is worthless so far as a cure is concerned. Probably the best drug of all in the majority of cases is antipyrine. Given in the dose of ½ to 3 grains (0.03–0.2) every five hours according to the age of the child it will nearly always decrease the number of paroxysms, but not the severity of each individual attack. (See Vaccine Therapy.)

In some cases remarkably good results occur by the use of ether injected into the gluteal region in the dose of 5 to 10 minims once a day. As children often protest because of the pain the ether may be used by enema using 1 dram of equal parts of ether and olive oil for each year of age and employing a catheter and funnel for its introduction.

When the child will submit to it there is little doubt that a solution of quinine applied to the pharynx by means of a very fine spray will be of service in many cases, and it is very useful when so used, as a prophylactic in other children of the family who it is feared will be attacked by the same disease, the reason being that the specific microörganisms of the disease chiefly exist in the epithelium at the root of the tongue. The strength of the solution to be employed should be about 1 grain (0.06) to 1 ounce of water.

A useful remedy in some cases is belladonna in the form of the tincture, in the dose of 2 minims (0.12) twice a day to a child of one or two years.

Where paroxysms come on so rapidly as to interfere seriously with respiration, the child should inhale a whiff of chloroform to relax the spasm, the drug being poured over the back of the parent's hand.

Benzine has been found useful in certain cases of whooping cough. It should be lightly sprinkled about the room or on the bed-clothing, care being taken that no fire or light is present.

Often the severity and frequency of the attacks may be modified by keeping the patient under a bronchitis-tent or by keeping the air of the room moistened by steam. (See Bronchitis.) In other cases great benefit arises from keeping the child out of doors.

WORMS.

Intestinal parasites may be said to be represented by Ascaris lumbricoides or *round-worm;* Tænia mediocanellata, Tænia solium, Tænia saginata, and Bothriocephalus latus, or *tape-worm; hook-worm,* (Necator americanus); the hook worm, and, finally, by Oxyuris vermicularis, sometimes called *seat-*, *pin-*, or *thread-worm.*

The round-worm, tape-worm, and hook-worm are to be attacked by way of the patient's mouth, the seat-worm by way of the anus.

Whenever a round-, hook-, or tape-worm is to be attacked, the patient must be starved for at least twelve to twenty-four hours, in order that no food in the intestinal tract may protect the worm from the action of the drug. During this time a little milk may be taken, and after a night of fasting, before breakfast, the anthelmintic must be swallowed. In addition, nearly all of these drugs must be followed by purges in order to dislodge the intruder while he is paralyzed and has lost his hold; and in many instances it is well to have a basin of salt and water ready, so that when a passage occurs a rectal injection may be given to wash out the worm in the rectum.

In the treatment of thread-worms it is necessary to fill the bowel thoroughly with soap and water to dislodge the fecal matter and expose the worms in the folds of the mucous membrane.

The drugs which are used against the round-worm are: Spigelia in the form of the fluidextract, dose 1 dram (4.0) to a child of two or three years, or 2 drams (8.0) to an adult, or, better still, the fluidextract of spigelia and senna, dose 2 to 3 drams (8.0–12.0) to a child; santonin, dose $\frac{1}{4}$ to $\frac{1}{2}$ grain (0.015-0.03) to a child in the form of a troche, *made by using the crystals*, or as much as 2 to 4 grains (0.12–0.25) to an adult. (See Santonin.)

Unless the spigelia is used with senna, it should always be followed after from two to four hours by a full dose of castor oil or a saline purgative to sweep out the worm, and the same rule applies to all the drugs mentioned above.

The most efficient remedy against the tape-worm is pelletierine, the active principle of pomegranate, dose 3 to 5 grains (0.2–0.3) in capsule; or pepo, or pumpkin-seeds (2 ounces [60.0]), may be resorted to when deprived of their outer coating and rubbed into a paste with sugar. Almost, if not quite, as valuable a remedy is male fern, or *Filix mas*, or, as it is officially called, *Aspidium*. Used in the form of the oleoresin (*Oleoresina Aspidii*), in the dose of $\frac{1}{2}$ to 1 dram (2.0-4.0) to an adult, it should be followed in three or four hours by a calomel purge, aided by a saline. Either the calomel or the increased amount of bile which is present is apparently peculiarly abhorrent to the tape-worm, and a free flow of bile should be made to follow the use of all the drugs just named. Aspidium should not be followed by castor or other oils, as they increase the absorbability of the drug, and so tend to develop symptoms of poisoning.

For the removal of hookworm, carbon tetrachloride should be given in capsule, (see Thymol, Carbon Tetrachloride and Chenopodium, Part II) remembering that if carbon tetrachloride is to be given for hookworm chenopodium should precede it by several days if ascaris lumbricoides are also present. Otherwise it is dangerous. (See Carbon Tetrachloride, Part II.) Furthermore, if the patient is a feeble child, it is well to use milk freely for several days to increase calcium reserve as this vermifuge seems to cause loss of this factor in salt balance.

By far the most useful remedy for seat-worms is quassia used by injection. One to 2 ounces (30.0-60.0) of powdered quassia or quassia chips may be made into a decoction with 1 pint (480 cc.) of water, and half of this injected into the rectum after it has been well cleansed with soap and water. The quassia injection should be retained in the bowel for some minutes, and in children this may be aided by pressing upon the anal opening the ball of the thumb covered by a pad formed from a small folded towel. If this treatment fails to bring away the worms in three or four trials, either there are none present or the bowel was not thoroughly invaded by the injection. In some cases the worms infest the colon, and large injections sent high up into the bowel are necessary.

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Horseback riding combined with gymnastic movements especially valuable, 741
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Podophyllin, gr. $\frac{1}{6}$ (0.01) if stools be dark, 740
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Salines, if attack is sudden, to sweep out retained feces, 738
Salol (phenyl salicylate) or aspirin, in 10-gr. (0.6) doses, useful as an intestinal antiseptic, 741
Stillingia, fluidextract of, dose, 20 drops (1.3), 741

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Formaldehyde useful, 308
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Ammonium chloride in second stage to stimulate bronchial tubes, prescription for, 101, 750
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Atropine, to check excessive secretion and stimulate respiration, 752
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Bronchitis-tent, 620, 748, 750
Caffeine, or strong coffee, to stimulate respiration if suffocation threatens, 752
Camphor, in old or atonic cases, 180; liniment rubbed on chest, 748
Cimicifuga in chronic bronchitis, 223
Climatic treatment in chronic bronchitis, 653
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Croton oil and sweet oil (half and half), sometimes applied to chest, 261
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Digitalis, if heart be feeble, 752
Dover's powder, gr. 5 to 10 (0.3–0.6), with a hot drink, useful in early stage, 748
Dry cups, if secretion is excessive, 752
Ethyl iodide, 5 to 10 minims (0.3–0.6), inhaled from a handkerchief every few hours in the later stages to loosen secretions, 734, 751
Eucalyptus oil, valuable in later stages, dose gtt. 1 to 5 (0.06–0.3), in capsule, every three hours, 304, 751
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Flaxseed tea, a useful demulcent, 306
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Terebene, if ammonium chloride fails, dose, 5 to 10 minims (0.3–0.6), in capsule or emulsions; must be stopped if kidneys or stomach are irritated; or used in an inhaler with equal parts of iodide of ethyl and chloroform, 535, 751
Terpine hydrate or terpinol useful, 535, 751
Thiocol in chronic bronchitis, 539
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Turpentine stupes, as counterirritants, 752
Water, hot and cold dashes, if death is imminent from suffocation, 752

BRONCHOCELE. (See EXOPHTHALMIC GOITER.)

BRONCHORRHEA.

Alum, solution, gr. 20 to the ounce (1.3: 30.0), applied in fine spray, 94
Strychnine, 427

BRUISES.

Alcohol, as a lotion, very useful, 84
Liquor plumbi subacetatis, locally applied, strength 1 to 4 ounces to the pint (30.0–120.0:480.0); contraindicated, if skin is broken; also useful as lead-water and laudanum (water 16, lead-water 4, laudanum 1), 368, 437
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Compresses, kept wet with lead-water and alcohol, or soaked with ichthyol solution, 1:40, over which is laid a water bottle, 749
Incision, at first sign of suppuration, followed by washing with Dakin's solution, and dressed antiseptically, 749
Lactogen, 662
Phenol solution (gr. 8 to the ounce [0.5: 30.0]), 10-minim injections, 456

BURNS AND SCALDS, 753

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Bath in the treatment of, 753
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Butesin picrate as a pain-relieving dressing, 168
Calcium carbonate, precipitated, as a dressing, 171
Camphor and phenol mixture useful, 181
Carron oil in, 177, 306
Castor oil, with a few drops of balsam of Peru or oil of eucalyptus, excellent, 193
Chloretone in 10 per cent ointment, 201
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Ichthyol ointment, 331
Lanolin, 362
Lead carbonate, as an ointment or, with linseed or other oils, as a dressing, 367
Lime-water and linseed oil, equal parts, is a standard application, 177, 306
Magnesium sulphate, 25 per cent solution, is an efficient dressing, 376
Morphine and atropine, gr. $\frac{1}{4}$ to $\frac{1}{2}$ (0.015–0.03) of former to gr. $\frac{1}{100}$ (0.0006) of latter, to allay pain, 753
Opium useful, 437
Orthoform, as an antiseptic anesthetic, 441
Paraffin dressing very useful, 754
Phenolized sweet oil, cosmoline, or simple cerate, useful application to counter-irritation burns, 455, 456
Picric acid a good dressing, 462
Resin cerate in superficial scalds, 482
Salicylic acid, prescription for, 491
Salt solution very useful when infected, 628
Scarlet red useful in slowly healing burns, 497
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Tannic acid largely used, 754
Transfusion, 664, 753
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Chloretone, 201
Condurango, in the dose of 1 dram (4.0) of the fluidextract, 254
Dionin as substitute for morphine, 277
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Transfusion in presence of anemia, 664

CANCRUM ORIS.

Arsenic internally, 122
Boric acid as mouth-wash, 158

CARBUNCLE, 755

Aluminum acetate useful, 95
General care of, 755
Magnesium sulphate, dried, pounds $1\frac{1}{2}$, mixed with ℥ 11 of glycerite of phenol and glycerin equal parts, applied as a paste, when a general anesthetic is contraindicated, 755
Phenol solution (gr. 8 to the ounce [0.5: 30.0]), hypodermic injections, to abort, 456
Pure phenol used to swab cavity surfaces after drying, 755
Phosphorus, 460

CARIES.

Lime salts, especially valuable in dental caries of nursing women, 175

CATARRH OF AIR-PASSAGES. (See NASAL CATARRH.)

Alum solution (in a weak solution), applied in fine spray, 94
Arsenic, internally, 122
Camphor of service in old and atonic cases, 180
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Iodide of potassium, if ammonium chloride fails to relieve, 337
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CEREBRAL DISEASE.

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Elaterium, in cerebral congestion, 279
Hypertonic saline solutions (15 per cent) to decrease intracranial pressure in brain tumor, or after injury to head, 642, 643
Jalap may be used to deplete in cerebral congestion, 358
Magnesium sulphate recommended in cerebral injury, 375
Methenamine to prevent infection in cerebral traumatisms, 403
Phosphorus, in cerebral softening, 460

CHANCRE.

Mercury bichloride, 1 to 2000, as wash to hard chancre; follow by sterile water, wipe dry, and apply thin coating of scarlet red ointment, 2 to 4 per cent, and dress with gauze, 998
Nitric acid, used as a caustic, surrounding tissues being protected by oil, 414
Salicylic acid, in soft chancres, 491

CHANCROID, 756

Acetanilid, used in a dry powder, 70
Actual cautery, the most destructive caustic, 756–758
Bismuth and zinc oxide, or calomel and bismuth are substitutes for iodoform, 757
Calomel ointment, 33 per cent, after prompt and thorough washing, to abort, 756
Cocaine, 5 per cent solution to relieve pain of cauterization, 756
Hot sitz-bath or general warm bath, 652, 757
Iodoform, the best palliative treatment, preceded by hydrogen peroxide spray 1:4, followed by a spray of mercury bichloride 1:4000, 757
Iodol or aristol, as a substitute for iodoform, 757
Lactogen, 662
Mercurochrome-220; in 1 per cent solution, applied locally, 378
Nitric acid, a good caustic, surrounding tissues, being protected by oil, 414, 756
Salicylic acid in powder or ointment, 491
Sulpharsphenamine claimed to be singularly efficacious, 520
Tartar emetic intravenously is very efficient, 106, 758

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Bismuth subnitrate, prescription for, 157
Boric acid, prescription for, 159
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Gambir, alone or with opium, in serous types, prescription for, 309, 799
Ginger, a good addition to diarrhea mixtures, 312
Guaiacol carbonate, in fermentative forms of, 317
Hematoxylon, useful in children, because of agreeable taste, 318
Hope's camphor mixture in serous and choleraic types, 322
Ipecac, gr. $\frac{1}{4}$ to $\frac{1}{2}$ (0.015–0.03), thrice daily, useful in summer diarrhea of children, 349, 800
Kino, formula for, 359, 799
Lactic acid bacillus useful in infantile diarrhea with putrefactive changes in the bowel, 361, 799
Lead acetate, with opium and camphor in serous types, prescription for, 367, 798
Lime salts and common salt freely in presence of rickets, 800
Mercury, with chalk or calomel, in hepatic disorder, 397, 799
Morphine, gr. $\frac{1}{80}$ to $\frac{1}{60}$ (0.0008–0.0012), hypodermically, often checks summer diarrhea in children, 437
Mustard plaster or other counterirritants to abdomen, 798, 800
Nitric acid and cardamom in mucous type, prescription for, 798
Nitro-muriatic acid or podophyllin, gr. $\frac{1}{50}$ to $\frac{1}{40}$ (0.0012–0.0015), in summer diarrhea, if duodenum is at fault, 419, 800
Nutmeg, useful in serous types, 424
Opium, 437, 798
Pancreatin in lienteric diarrhea, 444
Pepsin with hydrochloric acid in summer diarrhea, if gastric digestion is deficient, 800
Phenol, especially useful as an intestinal antiseptic, 455, 799
Phenolsulphonate of zinc, 2 grains (0.12), every three hours, of service in summer diarrhea, 457, 799
Phosphate of sodium, lime salts, and common salt in summer types, if rickets is present, 509, 800
Podophyllin, 469, 800
Precipitated carbonate of calcium, in serous diarrhea, 171
Protein milk in fermentative diarrhea of infants, 690
Raspberry leaves, used in domestic medicine, 486
Rhubarb, often useful, preceding direct treatment in summer diarrhea, 484
Salol (phenyl salicylate) combined with chalk mixture, 493, 799
Sulphate of iron in chronic forms, 356
Sulphuric acid, especially valuable in serous types, prescription for, 525, 799
Tannic acid, in atonic or serous types, 533
Tar mixture, highly recommended in obstinate types, formula for, 534
Zinc oxide, in summer types, 562
Zinc sulphate, 2-grain (0.12) pills, especially useful with opium or podophyllin, gr. $\frac{1}{60}$ (0.001), in serous types, 562

DIARRHEA (CHRONIC), 802

Ammonium chloride, gr. 5 (0.3) every four hours, best remedy in persistent catarrhal states, 802
Arsenic, 122
Counterirritation, 802
Diet, 802
Enteroclysis, 802
Ipecac, gr. 3 (0.2), every two hours, of service, in choleraic diarrheas, 349
Iron sulphate, gr. 5 (0.3), in pill, in chronic types, 356, 803
Nitric acid, with a bitter tonic, useful in green diarrhea of children, combined with pepsin, 415
Operative procedures when due to lesions of the rectum, 802
Podophyllum, 469
Potassium iodide, gr. 3 to 5 (0.2–0.3), if catarrhal state is obstinate, 802
Silver nitrate in pill form, or in other cases rectal injections of this drug, gr. 2 to oz. 1 (0.12–30.0), followed by iodoform suppository, of greatest benefit, 802

DILATATION (GASTRIC AND INTESTINAL).
Lavage, 644
Physostigma with nux vomica, 461

DIPHTHERIA, 803
Adrenalin and pituitrin of doubtful value, as they may induce fibrillation, 808
Alum, 94
Antistreptococcic serum, 585
Antitoxin, excels all other; 2000 to 5000 units should be thrown into an area where there is loose connective tissue; a special syringe is used for this purpose, and should be perfectly aseptic, 574, 803
Aromatic spirit of ammonia in cardiac failure, 808
Atropine useful for its effect on splanchnic vessels in collapse, 808
Borax solution, as a gargle in, 158
Bronchitis-tent in laryngeal cases, 809
Chlorate of potassium, contraindication for internal use because of danger to the kidneys; it may be applied upon a swab, 473, 809
Dextrose solution, 10 per cent, intravenously in presence of cardiac failure, 808
Diet, 808
Digitalis must not be given at all or with great caution, 808
Hypodermoclysis, 808
Ice-bags to the neck, ice in the mouth, and antitoxin, if glandular suppuration threatens, 809
Intubation if suffocation is imminent, 809
Lime-water as spray or application in, 177
Milk diet, 808
Monsel's solution, as a topical application, 356
Oxygen inhalations, strychnine, and atropine if suffocation is imminent; intubation or tracheotomy may be necessary, 808, 809
Peroxide of hydrogen is the best local application; may be applied on a swab or as a spray (1:4), to remove false membrane, 327, 803
Phenol (1:100) in the form of spray or gargle, 455
Potassium permanganate solution (gr. 20 to the pint [1.3:480.0]), applied as a swab or gargle, 476
Schick test, 806
Strychnine or caffeine hypodermically in presence of cardiac failure, 808
Tincture of the chloride of iron, 809
Tonics, such as quinine, strychnine and the chloride of iron, as supportive measures, 809
Toxin antitoxin as a preventive, 806
Tracheotomy if suffocation is imminent, 809

DROPSY, 809
Acet-theocin-sodium, 539
Acupuncture, less favorable than incisions, only to be resorted to after other remedies fail, 563, 814
Adonidin, useful in cardiac dropsy, 79
Ammonium chloride in full doses, 101, 811
Apocynum, in cardiac or renal dropsy of the subacute or chronic type, 114
Caffeine, in cardiac or renal dropsy, 813; in torpidity of kidneys, 170
Calcium chloride, 173
Calomel and digitalis, in renal and cardiac types, 395, 813
Colocynth, compound extract of, gr. 15 to 30 (1.0–2.0), 253, 811
Copaiba, of service in slow renal types, 255
Digitalis, ♏ 5 to 15 (0.3–1.0), with caffeine, gr. 2 (0.12), thrice daily, in renal torpidity due to heart trouble, 813
Diuretin useful in all conditions, except in the presence of acute nephritis, 505
Elaterium, especially useful in renal dropsy, 279, 811
Jalap, compound powder of, gr. 20 to 30 (1.3–2.0), with potassium bitartrate, gr. 15 (1.0), added, especially serviceable in renal dropsy, 358, 811
Karell treatment, 812
Magnesium sulphate, in concentrated solution, before breakfast, 375, 812
Milk diet, very useful, 813
Novasurol, 423
Paracentesis abdominis, very useful in ascites, 813
Pilocarpine contraindicated in cardiac types, 464
Pituitrin, ♏ 15 (1.0) twice a day, is often efficient in cardiac dropsy, 813
Potassium bitartrate with gin, in dropsy due to chronic nephritis, 472, 811
Potassium iodide, of value in some cases, but must be given cautiously if renal disease is present, 814
Salt-free diet, 811, 812
Salyrgen, 424
Scoparius (infusion), may be used, 498
Senega, rarely of value, 500
Squill with digitalis, prescription for, 512, 813
Strophanthus, in cardiac dropsy, 518
Sugar of milk, useful as a diuretic, 519

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Antidysenteric serum in bacillary dysentery, 575, 800
Arsenic, 122
Bichloride of mercury, gr. $\frac{1}{200}$ (0.0003), if passages are slimy and bloody; injections (1:5000), followed by solution (1:30,000) to prevent toxic effect by absorption, 392, 801
Bismuth subcarbonate, in full doses, to control excessive purging, 800
Boric acid, ʒj to Oj (4.0: 480.0), or phenolsulphonate of zinc, gr. 15 to 1 quart (1.0: 960.0), very useful as rectal injection, 801
Calomel, in purgative dose, contraindicated if weakness exists, 394, 800
Copaiba, 255
Copper sulphate, gr. 2 to the pint (0.12: 480.0), for irrigation of the colon, 256
Creolin enemata, 258
Diet, 800
Emetine hydrochloride, gr. ½ to ⅔ (0.03–0.04), in 30 minims of normal salt solution, an efficient substitute for ipecac, 348, 800, 801
Ergot, useful in bloody stools, 282
Flexner's polyvalent vaccine may be tried, 800

Hamamelis, injections, if much blood is present, 801
Ipecac, in acute dysentery, and is useful to prevent abscess if used early in amœbic dysentery and hepatitis, 348
Irrigation of colon, 610, 801
Lead acetate, with opium and camphor, prescription for, 367
Mercurochrome-220, 1 to 1000, by colonic lavage daily, 801
Prescription for enema, 801
Quinine injections, useful in amœbic dysentery, 231, 801
Rest in bed, 800
Shiga's serum may be tried, 800
Silver nitrate, rectal injections (gr. 10 to 20 to the pint [0.6–1.3:480.0]), if ulcers are chronic; followed by salt solution if action is too severe, 412, 801
Stovarsol, gr. (0.24) by the mouth t. i. d. on alternate weeks, used in amœbic dysentery, 515, 801
Sulphate of magnesium, 375, 800
Transfusion, 665
Yatren in amœbic dysentery, 559, 801

DYSMENORRHEA, 814

Amyl nitrite, 103
Antipyrine or acetanilide, in neuralgic attacks, in other cases of doubtful value, 111, 815
Belladonna, suppository, gr. $\frac{1}{2}$ (0.03) of extract; tincture internally, useful to relax spasm, 148
Camphor with acetanilide, in pill, useful in nervous cases, 180
Cannabis and gelsemium, often of service, 184, 815
Corpus luteum useful in some cases, 257
Epsom salt, if constipation is present, 814
Ether or chloroform, 815
Gelsemium, in spasmodic forms, 311, 815
Hot sitz-bath, followed by turpentine stupe, and Dover's powder, gr. 10 (0.6), often relieves, 615, 814
Hyoscyamus, extract, gr. 1, in suppository, if pain is persistent, 814
Iron, strychnine, and quinine as tonics, with rest and horseback riding for anemic and run-down patients, 815
Opium, to relieve spasm and pain, 435, 815
Ovarian extract, when due to the formation of clots, 441
Potassium bromide, 163
Water, cold and hot, alternately dashed over loins in atonic cases between periods, 815

DYSPEPSIA. (See INDIGESTION.)

Ammonium chloride, in painful dyspepsia due to hyperacidity, 101
Arsenic, useful in atonic types associated with chronic diarrhea, 122
Benzo-naphthol, in fermentative dyspepsia, 151
Bismuth, when due to acid fermentation, 157
Bismuth subgallate, in fermentative dyspepsia, 155
Diastase, with capsicum, in atonic dyspepsia, 264
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Lavage, in fermentative dyspepsia, 644
Nitric acid with bitter tonics, often relieves, 415
Quassia, useful if not due to gastritis, 482
Serpentaria, as a tonic in atonic types, 502
Strontium bromide, in painful dyspepsia, 516
Terebene, useful as an antiseptic in fermentative dyspepsia, 535

DYSPNEA, 815

Ammonium carbonate, as a respiratory and cardiac stimulant, 816
Arsenic, continuously employed, useful in emphysema and chronic pulmonary inflammation, 816
Digitalis in full dose, 816
Dry cupping over back, when due to cardiac or pulmonary trouble, 816
Heroin said to be of value in uremic dyspnea, 319
Hyoscine, contraindicated, 816
Morphine, gr. $\frac{1}{8}$ to $\frac{1}{4}$ (0.0080–0.015) night and morning, often cures when due to nervous or cardiac disorders, 438, 816
Opium, if due to heart disease, 816
Strychnine, in idiopathic types and when due to bronchorrhea in old people, 427, 816
Thoracentesis if there is pleural effusion, 816

DYSTROPHIA ADIPOSIS.

Antuitrin, 469
Pituitary gland, anterior lobe, gr. j (0.06) in tablets three times a day, 469

EAR (DISEASES OF).

Bismuth subgallate, useful in purulent otitis media, 155
Glycerin, useful to soften impacted cerumen, 314
Potassium permanganate, solution, useful in purulent otitis media, 477
Scarlet red to aid healing in perforation of tympanic membrane, 497

EARACHE, 816

Cardiac sedatives, 817
Chloroform, on swab, behind and in front of ear in otalgia, 818
Cocaine, ♏ 1 to 3 (0.06–0.2) of a 4 per cent solution, or adrenalin chloride (1:5000) solution, or a 2 per cent solution of ephedrin hydrochloride, dropped into nostril, followed by spray, if mucous membrane is engorged, 817
Heat dry, applied to head on affected side, 817
Leeching behind ear, to relieve pain, 817
Menthol and albolene spray, following cocaine, 817
Poultices, oil and laudanum, contraindicated, 817
Puncture of tympanum, if it bulge, followed by careful cleansing and insufflation of boric acid, 817
Tincture of belladonna and of opium dropped into the ear, 817

ECLAMPSIA, 972
Amyl nitrite, dangerous, 103
Anesthetics of little use, 974
Croton oil, 2 minims (0.1), mixed with sweet oil, placed on tongue, 973
Dextrose, when ketosis is present, 262, 973
Elaterium, gr. $\frac{1}{4}$ (0.015), rubbed up with butter, or compound jalap powder and calomel, may be substituted for croton oil, 973
Extraction of child rapidly as possible, if attack comes on during labor, 974
Hot-air bath, hot pack, or hot tub bath to induce sweating, 973
Ice-bag to head while in warm pack, 973
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Thyroid gland, full doses, for early symptoms of eclampsia, 543
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Ammoniated mercury in chronic dry form, 389
Arsenic, only when skin is very dry, 120, 820
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Ichthyol ointment, highly recommended, 331
Internal treatment, 820
Iodoform ointment, prescription for, 346
Iron, syrup of iodide, in young children with anemia and debility, 355
Kaolin as a dusting-powder, 359
Lead, dilute solution of subacetate, a useful lotion, 368
Liquor carbonis detergens, in acute cases, 819
McCall Anderson's ointment, 818
Method of removing scabs, 820
Methyl blue in eczema of the eyelids, 403
Neocinchophen in gouty type, 820
Ointments, prescriptions for, 819, 820
Phenol ointment, to prevent itching, 456, 819
Poultices, or olive oil with phenol (♏ 1 to 2 to the ounce [0.05–0.1:30.0]), followed by soap and water, necessary in some cases to soften scales, before use of ointments, 819
Resorcinol ointment (gr. 2 to 30 to the ounce [0.12 (2.0–30.0]), locally applied in subacute types; in chronic form, ointment (gr. 2 to 10 to the ounce [0.12–0.6:30.0]), solution, gr. 10 to 15 (0.6–1.0) to f℥j (30.0), in itching of erythematous form, 483, 819, 820
Salicylic acid ointment (gr. 30 to 60 [2.0–4.0], to lard 1 ounce [30.0]), in chronic or weeping types, 491, 820
Starch poultice, in crusty eczema, 514
Tar ointment, in chronic forms, 534, 820
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Zinc carbonate, as a protective powder in weeping eczema, 560
Zinc oxide, as a dusting-powder or ointment in early stages, applied directly or on lint, generally preceded by black wash, 561, 818

EMISSIONS, 821
Bromide of sodium or potassium gr. 20 (1.3) at bedtime, valuable in spinal irritability, 162, 821
Chloral, gr. 20 (1.3) at bedtime, 821
Cold sponging of perineum and scrotum, 821
Hygienic measures, 821
Hyoscine, gr. $\frac{1}{100}$ (0.0006), of great value, 330, 821
Potassium citrate, gr. 20 (1.3), thrice daily to render urine non-irritating, 821
Strychnine and arsenic, in full dose of great service in genital atony, 822
Warm bath before retiring, often useful, 821

EMPHYSEMA OF LUNGS.
Climatic treatment, 653
Cod-liver oil, useful, 249
Euphorbia pilulifera, $\frac{1}{2}$ to 1 dram, (2.0–4.0) of the fluidextract, 305
Iodide of potassium, 337
Physostigma, aids in expelling mucus, 462
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EMPYEMA.
Dakin's fluid, 945
Drainage in, 944, 945
Iodine, gr. 6 (0.4); potassium iodide, gr. 6 (0.4); water, 1 pint (500.0), as an irrigating fluid, used daily, 343
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ENCEPHALITIS, EPIDEMIC.
Neutral acriflavine 10 cc. of a 0.5 per cent solution intravenously in early stages, 78

ENDOCARDITIS, 822
Aconite, tincture of, ♏ 10 (0.6) hourly, in early stages of acute sthenic types, 822
Antistreptococcic serum in ulcerative endocarditis, 585
Blisters on precordium, to prevent endocardial complications, 822
Ice-bag over precordium, 588, 822
Iron, tincture of chloride, associated with supportive treatment, in infectious types, 822
Veratrum, used for same purposes as aconite, 822

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ENTERITIS. (See DYSENTERY AND DIARRHEA.)

EPIDIDYMITIS, 851

Guaiacol ointment, 5 per cent, to relieve pain, 851
Guaiacol used locally, highly recommended, 317
Heat, moisture, and pressure, in later stages, to relieve induration, 852
Iodide of potassium, gr. 10 to 15 (0.6–1.0), thrice daily, to remove induration, 852
Iodine, painted over scrotum, said to be beneficial, 604, 852
Lactogen, 662
Leeches on the perineum, 647
Magnesium sulphate solution to relieve pain, 376, 851
Mercury and belladonna ointments, equal parts, or iodine, gr. 4 (0.25), with lanolin ounce 1 (30.0), locally applied, to relieve induration, 852
Punctures, useful to relieve tension and alleviate pain, 851
Rest in bed, elevation of pelvis and testicles, cessation of local gonorrheal treatment, and administering treatment for acute inflammation, 851
Silver nitrate solution, painted over scrotum, in early stage, may relieve, 412, 604
Strapping and suspending testicle, to reduce inflammation, 604, 852
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Acetanilide and antipyrine, especially useful in some cases, 111, 823, 827
Adonis vernalis with bromides have been found useful, 79, 824
Amyl nitrite, inhalations, when aura is perceived and also in status epilepticus to relax spasm, 103, 825
Anesthetics contraindicated in all cases except status epilepticus, when chloroform may be used to control attack, 826
Belladonna, with bromides, recommended, 825
Bleeding for the status epilepticus, 826
Borax may be used, 158
Bromide of ammonium, may be used with other drugs, 99
Bromide of calcium, 166
Bromide of potassium, 162, 824
Bromide of sodium, no so apt to disorder stomach, 166, 823
Chloral, alone or with bromides, well diluted after meals, used with care, 199, 826
Dehydration, 827
Dialacetin, 264
Diet, 827
Digitalis, with bromides, useful in some cases, 825
Duboisine, especially in psychic forms, 278
Iodide of potassium useless except in syphilitics, 826
Luminal at night, 452, 823
Mercury, associated with potassium iodide when due to gumma, 826
Mixed treatments, 826
Nitroglycerin, used to supplement amyl nitrite, 417, 826
Nitroglycerin, useful in some cases of petit mal, 417, 826
Opium, only to be used when other remedies fail; also a prolonged course of, in ascending doses, useful in old cases, 824
Paraldehyde useful, 446
Phenolbarbital, gr. $1\frac{1}{2}$ to 3 (0.09–0.18) at bedtime, 823
Potassium nitrite, 415
Solanum carolinense, fluidextract of, 2 to 15 minims (0.12–1.0), thrice daily in the epilepsy of childhood, 827
Strontium bromide, 824

EPISCLERITIS, 828

Atropine locally, 828
Dionin, 5 per cent, to relieve pain, 828
Eserine or pilocarpine if there is a rise of intra-ocular tension, 828
Hot compresses, 828
Iodide of potassium and salicylates, 828
Subconjunctival injections of physiologic salt solution occasionally useful, 828
Tuberculin when tuberculous in origin, 828
Yellow oxide of mercury ointment, gr. j–℥j, for massage of eyeball, 828

EPISTAXIS, 828

Acetanilide, used locally, has been recommended, 71
Acetic acid, locally applied to arrest, 72
Aconite or veratrum, tincture, ♏ 5 to 10 (0.3–0.6), in sthenic cases, followed in thirty minutes by smaller doses, if necessary, 77, 829
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Bacon fat, inserted as a plug in nostril, may arrest, 829
Compression of facial artery may be necessary, 829
Cotarnine, locally, 257
Ergot, internally in slow oozing, 282
Gauze, dipped in liquid petrolatum, as nasal packing, 828
Hemostatic serum locally or hypodermically, 829
Hot foot-bath, or hot- or cold-water bags applied to dorsal vertebræ, may arrest, 829
Ice applied to nose, may arrest, 829
Monsel's solution, in spray (♏ 5 to 1 ounce [0.3:30.0]), only to be tried when other remedies fail; very disagreeable, 356
Phenol applied to bleeding spot by means of an applicator, 828
Plugging anterior and posterior nares, if necessary, 829
Silver nitrate solution, 50 per cent, applied to bleeding spot by means of an applicator, 828

EPITHELIOMA.

Acid nitrate of mercury, applied to part with glass rod, 398
Arsenic trioxide and gum acacia (of each 1 ounce [30.0] to water 5 fluidrams [20.0]), locally applied, 123
Resorcinol, in epithelioma of the face, 483

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Antistreptococcic serum, 585
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Bitters and iron, during convalescence, as tonics, 830
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Cold bathing to control excessive fever, 830
Ichthyol ointment and vaseline, half-and-half, locally applied, preceded by washing with Castile soap, followed by bichloride solution (1:1000), 331, 830
Iodine, tincture, painted around inflamed edges, to arrest, 342
Iron, tincture of chloride, ♏ 20 (1.3) to 40 (2.6) four times a day, well diluted, best internal treatment, 353, 829
Magnesium sulphate solution excellent, 376, 830
Rest in bed, 829
Silver nitrate, solution (gr. 80 to $\frac{1}{2}$ ounce [5.3:16.0]), applied twice or thrice to arrest, 412, 830
White-lead paint, locally applied when ichthyol is not at hand, 830

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Carbonate of calcium, precipitated, locally applied to sweating feet, 171
Cotton instead of woolen stocking may aid cure, 834
Formaldehyde, 833
Lead plaster and linseed oil, equal parts, applied on linen to feet, every third day, for sweating, 368
Prescription for dusting-powder, 833
Rest, absolute, of feet, may be necessary in swollen feet, 833
Salicylic acid and borax, equal parts, in water and glycerin, best application to sweating and tender feet, 833

FELON.

Bread-crumbs saturated with liquor plumbi subacetatis, as a poultice, to abort, 368
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Lactic acid (gr. 10 to the dram [0.6:4.0]), applied same as corrosive sublimate, 835
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Compression of gland with applications of belladonna ointment usually relieves, 971
Diet, 971
Ergot, long continued, highly recommended, 971
Pyrophosphate of iron, gr. 4 (0.25), in addition, if anemia is present, 971

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Bromine, as an escharotic in hospital gangrene, 166
Nitric acid, to destroy tissue, 414
Phenol or creosote, spray (♏ 5 to 15 to the ounce [0.3–1.3:30.0]), useful in pulmonary gangrene, 455

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Bismuth and phenol, after meals, to prevent pain, 157
Bromide of strontium, a valuable remedy, 516
Cannabis, prescription for, 183
Chloretone, gr. 5 to 10 (0.3–0.6), is useful, 201
Counterirritation and a vigorous revulsive, especially useful in hysteria, 604
Hydrocyanic acid, useful in nervous types, 326
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Arsenic, prescription for, 122
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Prescription for, in drunkards, 87

GASTRIC CATARRH (ACUTE), 825

Ammonium chloride, useful in subacute forms in children, prescription for, 101
Bismuth subnitrate, gr. 2 (10.2), or milk of bismuth, every two hours, 836
Diet, principal point in treatment, 836
Effervescing draughts, useful in convalescence, 836
Flannel, to protect abdomen, 837
Ice, to quench thirst, 836
Iron, if anemia exists, 837
Milk, with large percentage of lime-water, 836
Milk of magnesia, as a mild purge to dislodge fermenting mass, 836
Seidlitz powder, one-fourth to one powder every fifteen minutes, to settle stomach and remove mucus, 836
Sodium bicarbonate with gentian, useful, 836
Spice poultice to relieve epigastric distress, 605, 836

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Ammonium chloride, gr. 10 (0.6), useful, 837
Apomorphine as an emetic, to throw off mucus, 115
Arsenic for the vomiting, in hand-fed babies, 122
Bicarbonate of sodium for hyperacidity, 506
Blue mass, 837
Carlsbad salt, Saratoga-Carlsbad water, or Seidlitz powder of great benefit, 837
Cascara sagrada, if constipation exists, 837
Charcoal, prescription for, 188
Counterirritation, 837
Diet, such as carbohydrate foods digested with taka-diastase, 837
Hydrochloric acid, if due to atrophy of the gastric tubules, 324, 837
Hyoscyamus useful with silver nitrate, 328, 837
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Diet, 838
Exercise, 838
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Lavage, 644, 837, 838
Physostigma useful, combined with nux vomica, 461
Pituitrin, 467
Salicylic acid as an antiseptic when vomiting occurs and when the vomited matter contains sarcinæ, 490
Strychnine in full doses to aid digestion, 838
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GASTRIC AND DUODENAL ULCER, 839

Acetanilid, or phenol in 2 to 3 gr. (0.12–0.18) doses, with 20 gr. (1.2) of bismuth subnitrate to control vomiting, 842
Adrenalin chloride solution, ʒj (4.0), sometimes, gives good results in relieving hematemesis, 842
Arsenic, 122
Belladonna or hyoscyamus in large doses in pain due to pyloric spasm, 842
Bismuth and sodium bicarbonate, as an astringent and sedative, and to these may be added morphine, dionin or codeine for pain, 157, 841, 842
Calcium or magnesium phosphate, 15 to 60 gr. (1.0–4.0) three times a day after meals, 840
Carbolic acid for vomiting, 842
Carlsbad salt, magnesium sulphate, or sodium phosphate for relief of constipation, 842
Chloretone of value to relieve pain, 201, 842
Cocaine, gr. ¼ (0.015), alone or combined with bismuth, to control vomiting, 842
Cold compresses or an ice-bag applied to epigastrium in hematemesis, 842
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Metaphen, 401, 849
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Chloral, in insomnia, 855
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Cinchophen or neocinchophen useful, 238, 409
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Colchicum, tincture of seeds, 30 to 40 ♏. (2.0–2.6) should be given, and 20 ♏. more in twelve hours in acute types, 251, 854
Collodion, not more than one or two coats; also useful with iodine, 252, 854
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Iodide of sodium, to relieve night pains; also in chronic gout, 855
Iodine, ointment or tincture, locally applied to chronic gouty joints, 855
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Water, distilled or medicinal in large amounts, 854, 855

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(See Conjunctivitis, Granular.)

GRANULOMA INGUINALE.

Tartar emetic, 5 cc. of a 1 per cent solution intravenously, every other day, and increasing the dose by a drop each time until pain in the shoulder indicates the limit of tolerance, 106, 758

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(See Exophthalmic Goiter.)

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Methylene blue, 404
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Cocaine with bismuth and morphine, as a snuff, 243
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Nitrohydrochloric acid, ♏ 10 (0.65), after each meal and at midnight, asserted by some to be a specific, 419
Pituitrin, diluted from three to ten times with normal salt solution, locally in place of adrenalin, 468
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Bleeding, 856
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Calcium chloride or lactate, in persistent dull headache with decreased coagulation of blood, 175
Camphor, with acetanilide or antipyrine, in nervous headache, 180
Cannabis, when at menopause or due to retinal asthenopia, 183
Capsicum plaster to nape of neck, 187
Castor oil, daily, in neuralgic headache, 193
Cimicifuga, if due to eye-strain, 223
Colchicum, in gouty headache, 858
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Cup, to nape of neck, in congestion, 856
Ergot, if due to congestion, 282, 856
Gelsemium, if due to nervous troubles or eye-strain, 311
Horseback exercise and sleep very useful in obtaining relief from nervous headache, 857
Hydrobromic acid, if due to eye-strain in nervous women, 166
Hypertonic saline solution, intravenously, for relief of headache in inoperable brain tumor, 642
Ice-bag, applied to head, or leeches behind ears, in severe cases, 856
Liquor magnesii citratis, in sick headache, 374
Magnesium carbonate, gr. 5 to 60 (0.3–4.0), in sick headache due to gastric acidity, 373
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Mustard foot-bath and plaster to nape of neck, in congestion, 406, 604, 856
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Nux vomica, ♏ 1 (0.06) every five or ten minutes until 10 minims (0.6) are taken, in sick headache, 427
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Phenacetin, if due to eye-strain or neuralgia, 73
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Salicylic acid or iodide or acetate of potassium, if due to gout, 857
Sodium bicarbonate, as an antacid in sick headache, 506
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Aconite or veratrum, often useful in palpitation and hypertrophy, 77, 869, 870
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Adrenalin, ♏ 5 to 10 (0.3–0.6) of a 1 to 1000 solution hypodermically, is most effective in heart-block, 530, 864
Alcohol in heart failure due to shock or to poisons, 83
Ammonia and ether, followed by digitalis and alcohol, in heart failure, 97, 863, 867
Amyl nitrite, in single whiffs, often relieves cardiac failure, 103
Atropine, gr. $\frac{1}{100}$ (0.0006), four times a day, very useful in partial heart-block, 864
Barium chloride gr. $\frac{1}{2}$ (0.03) four times a day to prevent attacks, 864
Belladonna when arrhythmia is present, 869; in palpitation, 147
Caffeine, very useful, 170, 863, 869
Camphor, in palpitation, 180
Citrate or bitartrate of potassium with digitalis when secretion of urine is scanty, 869
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Convallaria majalis, in cardiac arrhythmia, 254
Dextrose, 20 per cent solution, intravenously for exhausted heart, 867
Diet, exercise and hygiene, 860, 869–871
Digestive remedies, in palpitation due to indigestion, 868
Digitalis, when heart fails, 271, 860–869
Donovan's solution, ♏ 5 (0.3) three times a day in water useful in heart disease with an old specific history, 867

Electric cabinet bath or hot-air treatment, 867
Dextrose intravenously for exhausted heart, 867
Hoffmann's anodyne, very useful in palpitation due to indigestion or tobacco, 320
Hydragogue cathartics for the dropsy and portal engorgement, 867
Iodides fatty heart, 871
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Rest cure valuable, 622, 859, 869
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Squill, as substitute for digitalis, in ruptured compensation with valvular disease, 513
Strophanthin, intravenously, or strophanthone hypodermically in presence of circulatory failure, 864, 867
Strophanthus, if digitalis fails, 518, 864, 866
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Adrenalin, 1 dram of a 1:1000 solution, 874
Bandages to extremities and external heat if faintness ensues, 874
Hamamelis, internally, 318
Morphine to produce general and gastric rest, and to aid formation of a clot, 874
Monsel's salt, gr. 2 to 3 (0.12–0.2), in pill, 356

HEMATURIA, 875

Adrenalin chloride (1:5000) as injection, 876
Alum, gr. 2 to 3 (0.12–0.2), to water 1 ounce (30.0), injected into bladder, if alarming, 876
Astringent injections, should be used only when bleeding is alarming, 876
Cups over kidneys, 876
Hamamelis, injected daily into bladder or used internally, 318
Morphine and atropine hypodermically and cups over kidneys in, 876
Quinine, usually harmful, unless due to malaria, 876
Sodium thiosulphate, 5 to 15 grains (0.3–1.0) every five hours, in malarial hematuria, 511, 876
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Esmarch bandages to limbs when aconite cannot be used, because of exsanguination, 874
Ice or ice-cold compress to the scrotum or vulva in, 874
Ipecac, in small doses, very effective, 349
Morphine, hypodermically, to allay nervousness and cough, 436, 874
Nitroglycerin, gr. $\frac{1}{100}$ to $\frac{1}{50}$ (0.0006–0.0015), 417, 873
Tannic acid, Monsel's solution, or alum used in spray, as styptics, of little value, prescriptions for, 355, 533

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Adrenalin in hemorrhage from small vessels, 527, 528
Alum, a useful styptic, applied to bleeding vessel, 94
Antipyrine, 112
Blood-serum, 1 ounce (30.0) daily by hypodermic injection, should be resorted to, 872
Calcium chloride and lactate, 172
Ceanothyn, used before operation to prevent postoperative hemorrhage, 195
Cinnamon, in uterine hemorrhage, 239
Compress, soaked in antiseptic liquid or filled with antiseptic powder, preferable to styptics, 872
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Hamamelis, useful for uterine oozing and bleeding from the bladder, 318
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Parathyroid gland seems of value in internal hemorrhage, 448
Sodium citrate 30 cc. of 30 per cent solution intravenously, 508
Sulphate of sodium by the mouth or intravenously; useless hypodermically, 510
Tannic acid, 533
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(See also HEMORRHAGE.)

Adrenalin chloride, 875
Chloride of calcium, 174
Enema, styptic, for hemorrhage from rectum or colon; adrenalin chloride, 4 drams of 1:1000 solution in ½ pint of normal salt solution; alum (gr. 10 to the ounce [0.6:30.0]), copper (gr. 5 to the ounce [0.3:30.0]), Monsel's solution (dr. ½ to 2 ounces [2.0:60.0]), Monsel's salt (gr. 10 to the ounce [0.6:30.0]) tannic acid (gr. 20 to the ounce [1.3:30.0]) of glycerin and water, 875
Ergot, 281
Human serum, horse serum or hemostatic serum, in melena neonatorum, 875
Ice-bag to the belly if patient is not in collapse, 875
Ice-water injections in bloody purging of dysentery, 875
Morphine hypodermically, 875
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Cocaine and iodoform ointment, prescription for, 877
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Gallic acid and ointment of stramonium equal parts, 309
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Iodoform suppository, if ulceration is present, 346
Lead-water and laudanum lotion, after acute stage is passed, 878
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Menthol and calomel ointment to relieve itching, prescription for, 878
Nitric acid, lightly touched to one or two points; as a lotion, ½ to 1 dram to the pint of water, in bleeding hemorrhoids, 415, 877
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Alpha lobelin has been found of value, 371
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Hot pack when due to uremia, 880
Lavage or purges when gastric or intestinal irritation is present, 879
Musk, gr. 20 (1.3), given by rectum, valuable in all cases, especially in typhoid fever, 879
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Sodium bicarbonate and magnesium carbonate if stomach is acid, prescription for, 880
Sodium bromide and tincture of opium by the bowel when life is threatened, 879
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Ammonium benzoate, potassium bitartrate, or methenamine, gr. 4 (0.25), in water, three times a day, if urine is concentrated and ammoniacal in odor, 881
Antiseptic fluids, to cleanse bladder, in paralysis, 882
Arsenic with nux vomica, in weakness of spinal centers, prescription for, 882
Belladonna, if due to vesical spasm, 148, 881, 882
Bromides with chloral, if due to vesical spasm, 162
Buchu, with sweet spirit of nitre, valuable in some cases, 167
Cantharides, ♏ ½ (0.03), with alkaline diuretics, thrice daily, in adults, 185, 882
Catheterization, in retention or paralysis, 882
Circumcision, if prepuce is redundant, relieves some cases, 881
Fowler's solution, ♏ ½ to 1 (0.03–0.06), in chronic types due to atony, 882
Hyoscyamus, if due to irritable bladder, 328
Potassium citrate, when due to acidity, 474, 881
Santonin, often valuable when other remedies fail, 495
Strychnine, 882
Sweet spirit of nitre and potassium citrate, if urine is dark and concentrated, prescription for, 532
Worms removed from vagina often cure, 881

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Asafœtida, in indigestion of old age, associated with flatulence, 141, 888
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Bitter tonics, useful in atony, contraindicated in gastric irritation, 884
Bromide of strontium, in excessive secretion, when not due to ulcer, 516, 886
Carbolic acid and bismuth, 886
Chloral, creosote, sodium thiosulphate, or thymol, with lavage when fermentation is excessive, 887
Chloroform spirit, ♏ 60 (4.0), often of great value, 888
Creosote, ♏ ½ to 2 (0.03–0.12), after meals in fermentation, due to deficient digestion of meats or the use of sweets, 260
Diastase, when starchy foods are not digested, 264
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Fats, excluded in fermentative types, 887
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Nitro-hydrochloric acid or nitric acid valuable in many cases, 415, 418, 888
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Pancreatin, with sodium bicarbonate and alkaline mineral waters in intestinal types, 445, 887
Pepsin, immediately after meals, 451
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Serpentaria, as a tonic, 502
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Test-meal, as a means of diagnosis, 884
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Vichy water before meals, 884
Yellow oxide of mercury, gr. $\frac{1}{60}$ to $\frac{1}{50}$ (0.001–0.0012), in trituration, if there is foul belching or ill-smelling stools, 399

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Aconite, in acute, 76
Bismuth in inflammation of mucous membranes, 157
Cannabis, valuable in chronic types, 184
Cantharidal blisters in deep-seated inflammations, 185
Cold applications, locally, 587
Flaxseed, for inflamed mucous membranes, 306
Liquor plumbi subacetatis, useful as a topical application, 366
Neosilvol for mucous membranes, 410
Opium, 436
Silver nitrate useful in all inflammations of the pharynx, larynx, fauces, and mouth, 413
Silvol for mucous membranes, 503
Sulphurated lime, useful to check, 179
Tartar emetic, in sthenic inflammation, 105
Terebene in genito-urinary inflammations, 535
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Alcohol, 892
Ammonium chloride and sandalwood oil to combat the bronchitis in later stages, 892
Antipyrine, phenacetin and acetanilide should be used only in small doses to allay pain, 889
Aspirin, gr. 5 (0.3), with cinchonidine sulphate, gr. 3 (0.2), in capsule, very useful, 881
Atropine combined with strychnine, if there be vasomotor paresis, 892
Barbital sodium, or dial, for insomnia, 893
Bromides, codeine, or morphine, if cough be excessive, 892, 893
Caffeine, gr. 3 (0.18), two or four times a day to combat exhaustion, 891
Cannabis, often valuable, if pushed, for irritative cough, 893
Castor oil or magnesium citrate, for constipation, 893
Cinchonidine sulphate is very useful, combined with salicin or one of the newer salicylates, 237
Cold bath preferable to antipyretics, for reduction of temperature, 890
Ergot, cannabis, with bromides, often relieve vertigo, 893
Ipecac and potassium citrate for the bronchitis in early stage, 892
Morphine as a sedative in delirium, 892
Novaspirin, 423
Phenacetin, 73, 889
Quinine sulphate with acetyl salicylic acid often used, 230
Remedies for bronchitis when present, 892
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Sandalwood oil for excessive cough, 494
Steam inhalations, laden with vaporized drugs, for cough, 892
Strychnine preferable to digitalis, if there be tendency to collapse, 892
Sweet spirit of nitre, and citrate of potassium, in combination valuable in early stage, 890
Vaccines, 893

INSANITY. (See MANIA, ACUTE.)

INSOMNIA, 894

Adalin, gr. 5 to 20, in tablet, useful, in mild insomnia and nervous irritability, 190
Allonal or peralga in insomnia with pain, 90
Barbital in nervous insomnia, 143, 894
Barbital sodium, 143, 894
Bath, cold, in cerebral anemia, hot, in nervous irritability, 589, 895
Bromide of strontium or sodium with Fowler's solution, in nervous females, prescription for, 163, 894
Chloral, useful if not due to pain, prescription for, 198, 894
Chloral and antipyrine if due to pain, 111
Chloral formamide, gr. 15 to 60 (1.0–4.0), in wine or capsule, in nervous insomnia, 200, 895
Chloretone, 201, 895
Chlorobrom, for insomnia of melancholia and acute mania, 201
Croton chloral preferable to chloral, if due to pain, 261
Dial in place of barbital, 263, 894
Dionin, to fortify or barbital sulphonal, 277
Drip-sheet in insomnia due to faulty cerebral circulation or nervous tension, 592
Duboisine more useful than hyoscine, 278
Exercise if patient follows a sedentary life, 896
Hot pack, in nervous insomnia, 620
Hot-water bags to feet and cold to head, or general hot bath, 589, 895
Hyoscine, gr. $\frac{1}{100}$ to $\frac{1}{80}$ (0.0006 -0.0007) by mouth, or gr. $\frac{1}{150}$ to $\frac{1}{100}$ to (0.0004–0.0006), hypodermically, in mania or hysteria, 329, 895
Luminal useful in nervous insomnia, 452
Morphine with chloral, if due to pain, prescription for, 895
Nux vomica and arsenic, or nux vomica and digitalis, during convalescence, 895
Opium, only to be used in pain, 435
Paraldehyde, 446, 895
Peralga, gr. 3 (0.2), used in insomnia due to pain, 452
Potassium bromide in nervousness and overwork, 162
Sodium bicarbonate if sleeplessness arises from acidity of stomach, 896
Sulphonal valuable in functional nervous insomnia, 521; prescription for, may be given in hot water, 894
Trional, in 15-grain (1.0) doses, 545
Valerian, in nervousness, 555

INTERMITTENT AND REMITTENT FEVER, 896

Alcohol, contraindicated during chill, 900
Arsenic, in intervals between attacks, as an antiperiodic, 120
Arsphenamine, 899
Calomel, gr. 1 (0.06) every fifteen minutes until 5 grains (0.3) are taken, four to five hours before quinine, if constipation is present, 899
Chloroform inhalations, preceded by laudanum, by mouth or rectum, or morphine, gr. $\frac{1}{6}$ (0.01), with atropine, gr. $\frac{1}{60}$ (0.001), hypodermically, if death threatens during chill, 900
Cool drinks and sponging, in fevered stage, cold with friction, 900
Digitalis or strychnine, to relieve internal congestion, during chill, 900
Ipecac or apomorphine, as an emetic, if chill follows full meal, 900
Methylene blue, gr. 1 to 4 (0.06–0.25), 404
Podophyllin, gr. $\frac{1}{10}$ to $\frac{1}{8}$ (0.006–0.008), preceding quinine, if constipation is present, 899
Quinine, as a prophylactic and antiperiodic, 898, 899

INTERTRIGO. (See CHAPPING.)

INTESTINAL OBSTRUCTION

Salt solution by hypodermoclysis, or intravenously useful, 628

INVOLUTION (ANOMALIES OF), 967

Application of nitric acid and silver nitrate useful in lacerations, 968

Cannabis of value in subinvolution, 184
Cimicifuga in subinvolution, 223
Digitalis in subinvolution due to sluggish circulation, 968
Ergotin, gr. 1 (0.06), hydrastinin, gr. $\frac{1}{2}$ (0.03), and stypticin, gr. 1 (0.06), in pill, if due to fibroids, 282
Pituitrin (1cc.) is declared to be the strongest stimulant to uterine contraction, 968
Hot water locally applied, if due to inflammation, 967
Removal of placenta, if adherent, 967

IRITIS, 902

Arsphenamine and neoarsphenamine in syphilitic iritis, 903
Atropine, the best local remedy, 149, 902
Colonic lavage often necessary, 904
Cyanide of mercury (1 to 5000), or physiological salt solution, subconjunctivally, 903
Daturine, scopolamine, or duboisine, when atropine cannot be used, 902
Dionin, 5 per cent solution, locally, for pain, 277, 903
Electric bath cabinet to induce free sweating, 903
Holocaine as a local anesthetic, 321, 903
Hyoscine valuable for pain, 330, 903
Iced compress, in early stage of traumatic iritis, 902
Insulin valuable in iritis associated with diabetes, 904
Iodide of potassium, alone or with mercury bichloride, following mercurial impression, in syphilitics, 903
Iridectomy required in some cases, 904
Leeches and dry heat or hot fomentations, to relieve pain, 615, 902
Mercury, preferably by inunction, if due to syphilis, 903
Morphine, if pain is severe, 903
Neisser's bacterin in gonorrhea iritis, 904
Paracentesis, 902
Phototherapy in tuberculous iridocyclitis, 904
Pilocarpine, internally, if vitreous becomes opaque, also in gonorrheal types, 902
Salicylate of sodium, or aspirin, in full dose in rheumatic iritis, 903
Scopolamine in early stages of, and in plastic, 330
Subconjunctival injections of cyanide of mercury (1:5000–1:1000), or of salt, solution recommended in syphilitic iritis, 903
Tuberculin recommended in iritis due to tuberculosis, 903, 904
Vaccines, autogenous, have given admirable results in certain forms, 904

IRRITABILITY.

Adalin useful, 190
Almonds, as a drink in irritability of intestines and air-passages, 91
Buchu in chronic vesical irritability, 167
Cantharis, recommended in atonic bladder, 185
Cimicifuga, in uterine irritability, 223
Hydrocyanic acid, in irritability of the stomach, 326
Hyoscyamus, for vesical irritability with incontinence, 328
Methenamine, in irritability due to alkaline urine, 402
Milk of magnesia in gastric irritability and acidity of adults and children, 374
Potassium bromide, in irritability of the pharynx, 162
Salicylates with bromides in nervous irritability of gouty or lithemic persons, 489

JAUNDICE.

Calomel, gr. $\frac{1}{6}$ (0.01) every half-hour until gr. 1 (0.06) is taken, if due to cold, 394
Carbolic acid (phenol), gr. 10 (0.6), with water and glycerin, each 2 drams (8.0), locally applied in itching of jaundice, 455
Hydrastis, useful in subacute types, 322
Iodoform, highly recommended, 346
Manganese sulphate, may be tried in malarial types, 378
Pilocarpine, useful unless due to malignant disease, 465
Salol, said to be of value, 493
Sodium phosphate of value, 509
Sodium thiosulphate has been used with great success in treatment of the jaundice and severe dermatitis following the use of arsphenamine in syphilis, 511
Transfusion in acute hemolytic jaundice, 664

JOINTS (INFLAMED).

Alcohol, locally, as a wash, 84
Camphor liniment, locally, 181
Mustard to allay pain, 405
Sodium salicylate or bicarbonate solution, to inflamed rheumatic joints, 506

JOINTS (RHEUMATIC).

Ichthyol ointment, 331
Oil of amber as a counterirritant over, 96
Oil of gaultheria in acute and chronic rheumatic joints, 310
Salicylic acid ointment useful, 490
Veratrine ointment, 556

KALA AZAR.

Tartar emetic, 106

KERATITIS (INTERSTITIAL), 904

Antiseptic lotions, in marked ciliary congestion, 905
Antisyphilitic treatment, if due to syphilis, 905
Arsphenamine and neoarsphenamine, 904
Atropine, in ciliary congestion, to prevent iritis, 905
Diet and hygiene, 905
Dionin valuable in 1 to 5 per cent solutions, 277, 905
Thymol iodide, as a dusting-powder, 540
Tuberculin efficacious in tuberculous cases, 905

KERATITIS (PHLYCTENULAR), 905

Atropine, to relieve pain, 905
Boric acid solution, to relieve congestion, 905
Cocaine, not advisable in photophobia, 906
Dark glasses, to protect eyes, 906
Holocaine (phenacaine) solution, 2 per cent, to relieve pain, 321, 906

Tonics and alteratives, with strict hygiene and regulated diet, associated with local treatment, 906
Yellow oxide of mercury ointment, or calomel as a dusting-powder, to hasten cicatrization, contraindicated if iodine is being given, 905

KERATITIS (ULCERATIVE), 906

Antidiphtheritic serum, 908
Antipneumococcus serum, 3 to 5 cc. subcutaneously in ulcers due to pneumococcus infection, 908
Antiseptic lotions, to limit sloughing, 907
Aolan, 5 cc. injected intramuscularly, 908
Atropine, instilled into eye, if there is any tendency to iritis, 907
Bandage, firmly applied, promotes healing and prevents perforation, 907
Cautery, actual, best means of preventing perforation, 907
Curetting floor of ulcer, if perforation threatens, 907
Dionin valuable in 5 per cent solutions, 277, 907
Eserine, instilled into eye, in peripheral ulcers, 907
Ethylhydrocuprein (optochin), 5 per cent, in pneumococcus ulcer, 908
Hot compresses, 615
Iodoform dusted on ulcer, 907
Massage of cornea and introduction of yellow oxide ointment to remove scars of ulcers, 909
Mercurochrome (1 per cent) or mercurophen (1:20,000) valuable, 907
Paracentesis, 907
"Pasteurization" of great value in infected corneal ulcer, 908
Phenacaine as an anesthetic, 321, 908
Phenol as application to ulcer, 907
Phototherapy, 908
Pressure bandage, if perforation threatens, 907
Protein therapy in form of whole boiled milk, 3 to 5 cc. intramuscularly, 908
Silver nitrate, tincture of iodine, or trichloracetic acid applied to margin of ulcer, if there is a tendency to spread, 907
Smoked glasses to protect the eyes, 907
Subconjunctival injections of cyanide of mercury (1:5000) or of salt solution to absorb corneal nebula, 908
Thermophore, Shahan's, as a means of applying heat to cornea, 908
Zinc sulphate, 1 per cent, touched to ulcer if Morax-Axenfeld bacilli are present, 907

LABOR. (See PARTURITION.)

LACRIMAL ABSCESS, 909

Division of canaliculi and washing out sac with antiseptic fluids, and insertion of probes into ducts after inflammation subsides, to restore patulency, 909
Excision of lacrimal sac best surgical procedure for chronic dacryocystitis, 909
Formaldehyde (1:6000), silver nitrate (1:500), or argyrol (2 to 5 per 100), injected through external opening if there is purulent discharge, 909
Hot compresses, to relieve pain, 909
Puncture of abscess, if rupture threatens, 909
Window resection of nasal duct recommended by some, 910

LARYNGISMUS STRIDULUS.

Amyl nitrite, 103
Belladonna, 148
Bromide of potassium, 163
Gelsemium, 311

LARYNGITIS (ACUTE), 910

Aconite to control fever, 911
Ammonium chloride, 911
Antipyrine, as a spray, 112
Bromides, useful in full doses, 60 to 120 grains (4.0–8.0) a day, 163
Calomel, small and repeated doses, followed by saline purges, along with hot mustard foot-baths and demulcent drinks, 911
Creosote spray in subacute laryngitis, 260
Cubeb cigarettes, useful for hoarseness of subacute forms, 262
Inhalations in, 633
Iodine, painted over throat, useful on third or fourth day, 911
Mustard plaster or hot applications over larynx, 910
Nitric acid, dilute, ♏ 2 to 3 every half hour or hour for six doses in early stage, 911
Nux vomica, for laryngeal stiffness, 911
Oil of amber and olive oil, half and half, well rubbed into the skin of the neck and chest, 96, 911
Prescriptions for sprays, 910, 911
Silver nitrate, 413
Steam inhalations, charged with benzoin; often advantageous to add menthol, 151, 633, 910

LEUCORRHEA, 911

Alum, gr. 10 to 20 to the ounce (0.6–1.3: 30.0), as a vaginal wash, 94
Belladonna, gr. 1 to 2 (0.06–0.12), with tannic acid, gr. 6 to 8 (0.4–0.5), applied with cotton, in disease of uterine cervix, 148
Cantharidal collodion, applied over groins to produce blister, 912
Goodell's prescription for, 912
Hematoxylon of service, 318
Hot sitz-bath, or vaginal injections of hot water, if due to uterine congestion, 615
Iron, with tonics, if due to excessive lactation or exhausting life, 912
Myrrh, if due to uterine trouble, 407
Nitrate of silver, when there is cervical ulceration, 413
Potassium permanganate (dram ½ [2.0] to water 1 pint [480.0]), as an injection, if discharge is fetid, 476, 913
Prescriptions for injection, 913
Ringer's prescription for wash, 913
Tampon, saturated with iodoform and tannic acid, 533, 913
White oak bark (ounce 1 [30.0] to water 1 pint [480.0]), or tannic acid and glycerin (ounce 1 [30.0] to 2 quarts [2 liters] of water), as an injection, 482, 913

LEUKEMIA.

Arsenic, useful, 718
Oxygen inhalations, 444

LICHEN.

Arsenic, usually cures, 120
Cantharides, 185
Phenol ointment in lichen planus, 456

LID ABSCESSES, 913

Treatment same as for other abscesses, 914

LITHEMIA. (See Gout.)

LOCOMOTOR ATAXIA.

Acetanilide, 70
Antipyrine relieves lancinating pains, 111
Arsphenamine (salvarsan), serum, 137
Chloralformamide, prescription for, 200
Coördinated movements in, 599
Phenacetin, 73
Potassium bromide, to prevent, laryngeal crises, 163
Salvarsanized serum, 133
Tryparsamide, 546

LUMBAGO, 914

Acetanilide, dose, gr. 4 to 8 (0.25–0.5), 914
Acupuncture, often relieves, especially if pain is bilateral, 562, 914
Antipyrine, dose, gr. 5 to 10 (0.3–0.6), 914
Aspirin, phenacetin, and salol, useful, combined or alone, 914
Capsicum plaster useful, 187
Chloroform liniment, 218
Cod-liver oil, 249
Foot-bath and Dover's powder, before retiring, often relieves, 914
Hot poultice to back often useful, 914
Ironing back with laundry iron, skin being protected by cloth or paper, very efficient, 615, 914
Mustard or capsicum plaster or blister over painful spot may relieve, 914
Potassium iodide or salicylic acid, if recovery is slow, 337, 913
Quinine and urea hydrochloride, intramuscularly, 232, 913
Salicylic acid, useful, 489, 913
Strapping often relieves sacro-iliac and lumbo-sacral pain, 914
Turpentine, gtt. 20 (1.3), said to be useful, 553

LUPUS.

Acid nitrate of mercury, 398
Ichthyol ointment, 331
Iodine, as a paint, to retard spread, 342
Protein therapy, 660

MALARIAL FEVER. (See Intermittent and Remittent Fevers.)

Antipyrine, 112
Arsenic, as a cure and prophylactic, 120
Arsphenamine useful, 228, 899
Calomel, 388
Eucalyptus, instead of quinine, when it cannot be borne, 304
Gelsemium, of doubtful value, 311
Hydrastis, as a tonic after malarial fever, 322
Mercurochrome, 379
Methylene blue, gr. 1 to 4 (0.05–0.2), 404
Quinine, the best remedy as a prophylactic and a cure, 227
Stovarsol useful, 515
Sulpharsphenamine claimed to be singularly efficacious, 520
Warburg's tincture, said to excel quinine in pernicious malarial regions, 558

MALARIAL FEVER (PERNICIOUS), 900

Mercurochrome useful, 379
Morphine and atropine, hypodermically to control retching and vomiting, 901
Quinine, 10 to 15 grains, intravenously, 864; must be used with great caution in hematuric or hemoglobinuric type, and not at all unless the malarial organism can be found in the blood, 900
Sodium thiosulphate, 60 grains every two or three hours, in malaria hematuria, 900
Stovarsol, 515
Water, copiously, with or without lemon juice, to flush the kidneys, 901

MANIA (ACUTE), 914

Anesthetics, or apomorphine in emetic dose, to relax muscular system, if patient is very violent, so that other remedies may be administered, 915
Bromide of potassium, as a soporific, 163
Cannabis, with large doses of bromides, particularly serviceable, 914
Chloral, in full doses, if kidneys are healthy, 914
Cold douche to head while body is immersed in hot water, often of service, 915
Duboisine, for insomnia, 278
Hot-steam bath or Russian bath valuable, 915
Hyoscine hydrobromide, gr. $\frac{1}{100}$ (0.0006), when necessary to quiet patient quickly, 329, 914
Morphine, in full dose, may be required to quiet patient, 914
Sulphonal as a hypnotic, 521
Thyroid gland, gr. 5 to 20 (0.3–1.3), 543

MARASMUS.

Cod-liver oil inunctions, one of the best remedies, 249
Mercury with chalk in syphilitic marasmus, 397

MASTITIS. (See Breast, Inflamed.)

MEASLES, 915

Convalescent serum, 915
Sweet spirit of nitre every hour or two, 915
Tepid sponging, 915
Warm pack to develop rash, 915

MELANCHOLIA, 917

Nitro-muriatic acid, ♏ 5 (0.3), in water after meals, if associated with oxaluria, 917
Phosphorus, 460
Thyroid gland, gr. 5 to 20 (0.3–1.3), 543

MENINGITIS (ACUTE), 917

Alcohol, given with food in second stage, if there be asthenia, 918
Antimeningitis serum is only remedy of real value, cerebrospinal form, 576, 917
Bromides and chloral, best agents to allay nervous symptoms, 917
Cistern puncture with drainage if coma comes on, 917
Ethylhydrocuprein, 302
Ice-bag to head, in early stage, 917
Leeches to nape of neck, in early stage, 647, 917
Lumbar puncture, if symptoms of cerebral pressure are marked, 650, 917
Milk diet, in second stage, 918
Opium, useful in second stage, 436
Quinine, contraindicated in acute stage, 918

MENOPAUSE.

Bromide of potassium, in nervous disorders, 162
Cannabis, alone or with aloes and iron, if anemia or constipation exist in headaches of the menopause, 183
Corpus luteum useful, 257
Eau de Cologne, saturated with camphor, locally applied in headache or drowsiness, 181
Ovarian extract, for nervous and nutritional disturbance, 441
Valerate of ammonium, in nervous disorders, 101

MENORRHAGIA AND METRORRHAGIA, 872

Adrenalin chloride (1:5000) may be employed, 527
Bromide of potassium or sodium, gr. 10 (0.6) once or twice daily, if bleeding is irregular, 163, 873
Cannabis, recommended, 184, 873
Cinnamon oil, dram ½ (2.0), when erigeron is not at hand, in oozing flow, 873
Cotarnine chloride, gr. 1 to 4 (0.06–0.24), four times a day, useful, 257, 873
Curettage, 873
Dry cups over sacrum, if due to congestion, 873
Ergot, fluidextract, ♏ 10 to 60 (0.6–4.0), best remedy in active bleeding, 282, 873
Erigeron, oil of, ♏ 3 to 5 (0.2–0.3), in capsule or emulsion, for oozing, 873
Monsel's solution (50 per cent), full strength locally applied if due to polypus, 356
Radium applications, 873
Turpentine, often of value, 553

MENSTRUATION.

Aconite in suppression of, due to cold, 77
Corpus luteum seems to do good in scanty menstruation, 257
Rest cure in disorders of menstruation, 662
Turkish bath, 617

MIGRAINE, 918

Amyl nitrite, 103
Bacillus acidophilus, often very valuable, 918
Blue mass, gr. 5 to 10 (0.3–0.6), followed by a saline, is at times beneficial, 918
Bromide of potassium, with caffeine, almost a specific, if due to eye-strain, 163
Cannabis, extract, gr. ¼ to ½ (0.015–0.03), with tincture of gelsemium, gtt. 10 to 20 (0.6–1.3), every two hours, 183, 918
Corpus luteum in menstrual migraine, 257
Croton chloral, very efficient, 261
Epsom salts at night, 918
Gelsemium, with cannabis, to abort, 311, 918
Luminal, gr. ½ (0.03) morning and night, 452
Menthol pencil useful externally, 450
Phenacetin, 73
Procaine, 919
Salicylic acid, of great service in rheumatic types, 489
Sodium, phosphate, in hot water taken in morning, 918
Turbinectomy, 919

MILK DEFICIENCY, 970

Bier's cups, to produce local hyperemia, have proved efficient, 970
Electricity, 970
Pituitrin, 970
Treatment for intercurrent affection, if due to such cause, 970

MORPHIOMANIA. (See Poisoning from Opium, Chronic.)

Bromide of potassium, 163
Hyoscine, in full dose, 330
Phosphorus, of service in sequelæ of morphiomania, 460

MUCOUS MEMBRANE (DISEASES OF).

Adrenalin in engorgement, 527
Arsenic, of value in atony of mucous membranes, 120
Bismuth, as an astringent, to inflamed membranes, 157
Flaxseed, as a soothing demulcent, 306
Glycerole of aloes, locally applied to fissures, valuable, 93
Opium, suppositories, gr. ¼ (0.015), useful in rectal inflammation, if not an acute catarrh, 436
Tannic acid, useful, in depressed conditions, 533
Terebene, useful in subacute and chronic genito-urinary inflammation, instead of sandalwood or copaiba, 535
Zinc sulphate, weak solution, as an astringent, 562

MUSCÆ VOLITANTES, 919

Alteratives and correction of anomalies of refraction, 919

MUSCULAR STIFFNESS.

Hot laundry iron passed over part, skin being protected by layers of paper or cloth, often relieves, 615

MYLAGIA, 919

Ammonium chloride, if due to cold or bruises, 919
Acetylsalicylic acid, 919
Camphor liniment, 181

Chloroform liniment, 919
Cimicifuga, fluidextract, ♏ 20 to 1 dram (1.3–4.0), 919
Clove oil, added to liniment, as a counter-irritant, 240
Heat, high, or infra-red rays from a zoalite lamp are very useful, 919
Iodide of potassium or salicylates, if due to rheumatism, 919
Iodine ointment, pure or diluted with lard, 919
Massage or good rubbing, very necessary, 919
Prescription for liniment, 919

MYXEDEMA.

Thyroid gland, or extract of, a specific for, 542
Thyroxin, gr. $\frac{1}{40}$ to $\frac{1}{50}$ (0.0015–0.0012) a day, to adults, 543, 544

NASAL CATARRH (ATROPHIC), 920

Dobell's solution, as a cleansing wash; carbolic acid may be increased, or thymol and eucalyptus substituted for it, to relieve odor, 159, 920
Galvano-cautery, or strong silver nitrate solution, if ulcerations are present, 921
Hydrogen peroxide, 920
Ichthyol, useful, 920
Iodine and glycerin, with potassium iodide, sufficient to cause solution of the iodine, valuable locally applied, 921
Potassium iodide internally, tonics and stimulants to mucous membrane, and attention to activity of skin, 921
Potassium permanganate, useful; painful if sensation is not entirely lost, 920
Removal of necrosed bone, 921
Silver nitrate and starch (gr. 1 to 10 [0.06–0.6] to drams 2½ [10.0]), as an insufflation powder, or solution (gr. 1 to 10 to the ounce [0.06–0.6:30.0]), better in some cases, locally applied, 921

NASAL CATARRH (CHRONIC), 921

Alkaline wash, 922
Arsenic, 122
Camphor, 180
Ferric alum (gr. 5 to the ounce [0.3:30.0]), useful, in spray, in later stage, 922
Iodine and glycerin (gr. 6 to 8 to the ounce [0.4–0.6:30.0]), with potassium iodide, sufficient to cause solution of the iodine locally applied, 922

NAUSEA. (See Vomiting.)

Hoffmann's anodyne, when due to excessive use of tobacco, 320
Hydrocyanic acid, dilute, ♏ 3 (0.2), in water, often useful, 326
Lime-water, 177
Seidlitz powder, when associated with constipation, 500

NEPHRITIS (ACUTE), 922

Aconite, to depress circulation, 923
Blisters contraindicated, 923
Bromides or opium, given cautiously if, aconite fails to quite restlessness, 923
Cannabis, if hematuria is present, also to allay pain over kidney, 184, 923
Cups or leeches over loins if urine is scanty, 922
Diet, 923
Digitalis with squill or calomel, gradually increased, followed by gin or compound spirit of juniper in later stages, 273
Flaxseed tea, as a demulcent, 306, 923
Hot-air baths, useful to provoke sweat, 923
Juniper, to reëstablish secretion, after inflammation has subsided, 359
Potassium bitartrate, 472
Sulphate of magnesium, ℥ss (10.0), or calomel, to aid in elimination of toxic products by bowel, 923
Sweet spirit of nitre, to increase flow of urine, 923
Turkish bath, to aid in eliminating effete products, used with care, 616

NEPHRITIS (CHRONIC), 923

Ammonium acetate useful in parenchymatous type, 926
Basham's mixture for anemia, 353, 926
Blue mass, gr. 10 (0.6) with compound extract of colocynth to relieve dropsy, 926
Capsicum, to check albuminuria, 187
Chloride of iron if anemia is present; to decrease albuminuria, 353
Diet, 924–926, 927
Digitalis and caffeine useful, 273, 926
Elaterium or jalap, to relieve dropsy, 926
Electric cabinet bath, 927
Hot baths, or hot packs, 926
Juniper of value, 359
Methylene blue solution hypodermically, when kidney is suspected of being inadequate, 405
Nitrite of sodium useful in ascending doses in chronic interstitial nephritis, 416, 927
Nitroglycerin, with cardiac disturbance and high arterial tension, 417
Potassium acetate or bitartrate combined with digitalis, or the bitartrate combined with gin or compound infusion of juniper, 472, 927
Potassium iodide, gr. 5 (0.3) thrice daily used with great care, in contracted kidney, 337
Proteins often needed, 927
Protiodide of mercury useful, 399
Salt-free diet in, 925, 927
Sodium iodide of great value in many cases, 927
Squill, 513
Strontium lactate, for the relief of albuminuria, 516
Transfusion in presence of severe anemia, 664

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Asafœtida in nervous irritability of children, 141
Bromides, 162
Camphor, as a sedative, 179
Corpus luteum in nervous disturbances during artificial menopause, 313
Phosphorus, in nervous debility and exhaustion, 460
Rest-cure very useful where nervousness is due to exhaustion, 662

Strychnine, in functional nervous atony or depression, 426
Sweet spirit of nitre, in nervous excitement of fever and other nervous states of infancy, 532
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Acetanilide useful, 70, 929
Acetylsalicylic acid, gr. 5 to 20 (0.3–1.2) is very efficacious, 929
Aconite ointment (gr. 2 to the dram [0.12: 4.0]), or oleate of aconitine (gr. 2 [0.12] to sweet oil 100 minims [6.6]), useful applied over painful spot, if limited in area, 76
Alcohol injections in sphenopalatine neuralgia, 930
Allonal, 90
Amyl nitrite, inhalations, when due to anemia, 930
Antipyrine, with chloral, very useful, especially in gout, rheumatism, or nervous depression, 111, 929
Aspirin, gr. 5 to 20 (0.3–1.3), in tablet or capsule, is very efficacious, 74, 929
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Bromide of potassium with caffeine, almost a specific, 163, 929
Cacodylate of iron and sodium, with glycerophosphates, useful in presence of nervous exhaustion, especially in convalescence from acute fevers, 929
Camphor liniment, locally applied, to relieve pain, 181
Castor oil, oz. 1 to 2 (30.0–60.0) a day, at times gives good results, 193, 930
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Chloral locally, prescription for, 199
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Croton chloral, gr. 5 to 20 (0.3–1.3) in 5-gr. pills, often effective in brow neuralgia, 261, 930
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Gelsemium in full doses may be used, 929
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Iodide of potassium, may be tried in rheumatic neuralgia, 337
Iron and arsenic, in anemia; often necessary to associate with them bitter tonics and cod-liver oil, 928
Magnesium sulphate solution locally, 376
Menthol locally, 450, 930
Morphine, gr. ⅕ to ¼ (0.012–0.015), injected into painful spot, if localized; not advisable in chronic cases, 930
Mustard plaster, as a counterirritant, 406
Neurectomy, 930
Novaspirin, 423
Nux vomica or strychnine, if nerve is depressed by anemia, 928
Peppermint oil, locally applied on cloth over painful spot, 449
Peralga, gr. 3 (0.2), 452
Phenacetin, gr. 3 to 8 (0.2–0.5), very useful, prescription for, 73, 929
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Alum dissolved in water or alcohol, efficient application for sponging, 94
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Zinc oxide, prescription for, 562

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Benzoin, tincture, locally applied, 966
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Breast-pump or nipple-shield may be necessary to effect cure, 966
Cocaine (2 per cent) applied and washed off before nursing, if breast is very painful, 966
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OPHTHALMIA (SYMPATHETIC), 934

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Benzosalin in full doses, 935
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Chrysarobin, gr. $\frac{1}{8}$ (0.008), internally, or the ointment, with benzoated lard (1:4 or 5), locally applied, in parasitic skin diseases; must not be used on face, 223
Mercurial ointment, useful to destroy pediculus pubis or other parasites, 398
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Elaterium, useful in effusions, 279
Ice-bag over the precordium, very useful, 588, 936
Iodide of potassium, to aid in absorption of fluid, 337
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Acetanilide, gr. 2 (0.12), every two or three hours, with brandy and ice, for vomiting, 938
Counterirritation, 604
Enteroclysis, 939
Ice-bag or turpentine stupe to abdomen; leeches in sthenic cases, 938
Lavage, gastric, often advantageous, 939
Murphy drip in postoperative or septic peritonitis, 939, 940
Opium pushed until pain is relieved, but never to the point of obtunding intelligence, 436, 938

Rectal tube, milk of asafœtida or turpentine injections, in tympanites, 941
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Quinine, large doses, in solution, by mouth, rectum, or hypodermically, 230, 900
Thiosulphate of sodium, gr. 60 (4.0), to move the bowels, 900

PHARYNGITIS.

Antipyrine, in 4 per cent spray, 112
Cocaine, gives temporary relief; after-effects bad, 243
Cubebs, troches of, used in chronic types, 262
Mercurochrome-220, 2 per cent, diluted one-half, 379
Monsel's solution, pure or diluted one-half with glycerin, applied on pledgets of cotton or camel-hair brush, 356
Phenol solution, 1 to 500, as a gargle in septic pharyngitis, 456
Potassium chlorate, as a gargle, 473
Salol (phenyl salicylate), in 5-grain (0.3) doses, 493
Silver nitrate solution, in varying strength, locally applied, 413
Silvol in early stages, 504
Turkish bath in acute forms when pharynx feels raw, 617

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PITYRIASIS VERSICOLOR.

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Aspiration, when hydragogue purges fail to remove effusion, 943
Cantharidal blister, two inches below axilla, aids absorption of effusion, 602, 943
Chloramine-T may be used in 0.5 to 1 per cent watery solution, in place of Dakin's solution, 945
Codeine, morphine or Dover's powder may be given to relieve pain, 942
Cotton jacket, 942
Dakin's solution, 945
Elaterium or jalap, useful to remove effusion, 279
Gelsemium, 311
Gentian violet solutions, 1 to 5000 and 1 to 1000, for irrigation of pleural cavity, 945
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Iodine, locally applied, to abort, and aid absorption of fluid, 342
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Purges, in second stage, to remove effusion, ought not to be used, 943
Salicylates useful for the removal of effusion, 489
Strapping chest, if respiratory movements are very painful, 941

PLEURODYNIA. (See NEURALGIA.)

PNEUMONIA, 946

Alcohol as a cardiac stimulant in the second stage in adults, 83, 949
Ammonia useful for adults and children and in the presence of sudden collapse, 97, 952
Ammonium bromide and carbonate may be used if morphine cannot be used, 954
Ammonium chloride, as an expectorant in third stage, 954
Antipneumococcic serum, 578
Asafœtida, by rectal injections, in tympanites, 141
Belladonna, very useful, if there are evidences of collapse, 149, 950, 952
Camphor in almond oil hypodermically in sudden depression, 180
Citrate of potassium to maintain renal activity, 953
Climatic treatment in convalescence, 653
Codeine, gr. ¼ every eight hours for cough, 954
Cold compresses, locally, 948
Cold sponging for fever, 948
Dextrose solution intravenously, 952
Digitalis, tincture, ♏ 10 (0.6), every eight hours accompanied by belladonna, ♏ 10 (0.6), every four hours, carefully watched in second stage, 272, 950
Dover's powder for pain at onset, 948
Ethylhydrocuprein and efficient destroyer of pneumococci, 302
Fresh air, 947
Gelsemium, in early stages, 311
Gin, to maintain renal activity, 83, 359, 953
Ice-bag to heart if fever be high and heart tumultuous, 588, 948
Iodide of potassium, in later stages to absorb exudates, 338, 953
Morphine, for pain at onset, and for excessive cough and persistent insomnia, 436, 948, 953
Oxygen inhalations if asphyxia threatens, 443, 952
Phosphorus, 460
Prescriptions for use in third stage, 954
Pulmonary exercises in delayed resolution, 630
Spirit of ether or aromatic spirit of ammonia, 1 dram of each every hour if collapse threatens, 952
Strychnine as a respiratory and circulatory stimulant in second stage and as an adjuvant to digitalis, 426, 950; also hypodermically in full dose should collapse develop, 952

Vaccines are a prophylactic, 674
Venesection, when heart is laboring and veins distended, 680, 952

POISONING FROM—

Acetanilide.

Supportive measures, stimulants, external heat, belladonna to maintain blood-pressure, strychnine to counteract respiratory failure, and oxygen inhalation to overcome cyanosis, 69

Acetate of Zinc.

Treatment same as for gastro-enteritis, 560

Acetic Acid.

Large amounts of milk, alkaline liquids, and general treatment for gastro-enteritis, 72

Aconite.

Keep patient in prone position, with feet higher than head. Hot applications; emetics contraindicated; evacuate stomach by siphon or stomach-pump. Ether hypodermically, or aromatic spirit of ammonia by mouth, followed by digitalis. Artificial respiration and amyl nitrite a few whiffs, no more, if heart fails; atropine, strychnine, 76

Alcohol (Acute).

External heat, digitalis and strychnine hypodermically, in coma, if heart fails. Belladonna, if the skin is relaxed and clammy, and counterirritation to nape of neck for brain symptoms. After-treatment, ammonia, spices, spirit of Mindererus; emollients in gastritis, ice, or ipecac in minute dose, and counterirritation for vomiting. Jalap, gr. 40 (2.6), elaterium, gr. ⅛ (0.008), or calomel and salines, as purgatives, 84
Fowler's solution for morning vomiting, 85

Alcohol (Chronic).

Withdrawal of drug, at once or gradually. Highly seasoned broths, predigested food, and digitalis or strychnine, in small doses, if the patient be weak. Koumyss is valuable and nutritious under these circumstances. Capsicum, prescriptions, 87, 186

Antimony.

Large doses of tannic acid, external heat, alcohol, digitalis and morphine hypodermically, if respiration is not too feeble. If necessary to use opium, it should be accompanied by strychnine. Prone position, patient vomiting into towels. Stomach-pump, if vomiting is absent, 107

Antipyrine.

Maintain bodily heat, stimulants, atropine and oxygen inhalations, if cyanosis is alarming, 110

Arsenic (Acute and Chronic).

Stomach-pump, external heat, stimulants and the chemical antidote, hydrated sesquioxide of iron and magnesia. Magnesia also useful by itself. Opium should follow antidote, to allay pain, also large draughts of water to flush kidneys and dilute the poison. For chronic poisoning, iodide of potassium, tonics, electricity, and out-of-door life, 127

Belladonna.

External heat if collapse intervenes, and strychnine to support respiration. The physiological antidote, opium, may be carefully given, 147

Carbolic Acid (Phenol).

Soluble sulphates, as Epsom or Glauber salts, warm mucilaginous drinks, hot applications to extremities, digitalis, strychnine, and counterirritation over abdomen. Emetics and stomach-pump should be used if possible, 454

Chloral.

External heat, emetics in early and stomach pump in later stages. Strychnine or atropine to stimulate respiration. Digitalis preceded by ether, ammonia and brandy, or whisky. Prone position feet being elevated, 198

Chloroform.

Artificial respiration, ether and hot brandy hypodermically. Poles of battery with rapidly interrupted current swept over body, not over diaphragm or phrenic nerve. Place patient with head downward. Compression of the abdomen and limbs; compression and massage of the precordium. Atropine, strychnine and digitalis to stimulate the heart and respiration. Laborde's lingual traction, 218

Cocaine.

Ammonia, coffee, strychnine, ether and alcohol. If convulsive in type, treat same as strychnine-poisoning, 246
Sodium barbital, 144

Colchicum.

Tannic acid, emetics and stomach-pump. Opium to relieve pain and oils. Atropine and stimulants if collapse comes on, 251

Copper.

Yellow prussiate of potassium, sweet oil, white of egg; followed instantly by emetics or stomach-pump. If emesis or purgation is present, emetics are contraindicated; instead, mustard plaster over abdomen, and opium internally, are often employed, 255

Corrosive Sublimate.

Large amounts of white of egg, followed by stomach-pump, external heat, stimulants, 390
Sodium thiosulphate is the best antidote, 511

Croton Oil.

Treatment same as for gastro-enteritis, 261

Digitalis.

Tannic acid as a chemical antidote, emetics or stomach pump, external heat to abdomen, and aconite as a physiological antidote. Maintain horizontal position, 274

Elaterium.

Treatment same as for gastro-enteritis, 279

Ether.

Artificial respiration, lowering head if face is pale; strychnine, atropine, and digitalis hypodermically, or ammonia to stimulate heart and respiration; friction and hot applications; ether dashed on chest and abdomen; Laborde's method of traction of the tongue, 289

Eucaine.

Treatment like that of cocaine intoxication, 303

Formaldehyde.

Ammonia water, chemical antidote; wash out stomach, soothing drinks, morphine for pain, 308

Gelsemium.

Emetics and stomach-pump, digitalis, atropine, and ammonia as cardiac stimulants; external heat, strychnine and atropine for respiratory center, 311

Iodine.

Emetics or stomach-pump, large amounts of starch, hot applications, and hypodermic injections of alcohol, atropine, digitalis or strychnine, 340

Iodoform.

Sodium bicarbonate to combine with iodine, alcohol, diuretics and hot blankets; saline transfusion, 345

Lead (Acute).

Epsom or Glauber salts, in large amounts; alum; emetics or stomach-pump. Hot applications and opium to relieve pain, 363

Lead (Chronic).

Jalap and calomel with opium or alum, gr. 2 (0.12) in full dose, valuable in lead colic. Blister to back of neck, in cerebral inflammation. Iodide of potassium to eliminate lead. Strychnine in progressive paralysis. Electricity and baths of sulphuret of potassium, 365

Mineral Acids.

Alkalies, such as magnesium, lime, whitewash and soap as antidotes; white of egg, external heat, oils and opium, to relieve irritation.

Monsel's Solution.

Soap, 356

Nitrate of Silver (Acute.)

Common salt as the chemical antidote, opium and oils to allay irritation; also large amounts of milk and soap and water; maintain bodily heat, 411

Nitrate of Silver (Chronic).

Iodide of potassium, to aid in eliminating poison, 411

Nux Vomica and Its Alkaloids.

Inhalations of amyl nitrite, to prevent convulsive tendencies; at the same time use stomach-pump. Tannic acid followed by physiological antidotes, potassium bromide, gr. 60 (2.0), with chloral, gr. 20 (1.3). If convulsions prevent swallowing, chloroform patient carefully and give antidotes by rectum in starch-water. Amyl nitrite, hypodermically, if relaxation does not occur, 429

Opium (Acute).

Emetics, or stomach-pump, tannic acid, black coffee, electricity and other measures to keep patient awake. Atropine or strychnine, hypodermically, if respiration fails. Alcohol, ammonia and external heat. Artificial respiration may be necessary; repeated washing out of stomach. Permanganate of potassium, 432

Opium (Chronic).

Decrease a sixth or fourth of customary amount each twenty-four hours. Cocaine not advisable as a substitute, as the cocaine habit may be established. Digitalis and strychnine if heart fails. Hyoscine hydrobromide in large doses very valuable, 434

Phosphorus.

Permanganate of potassium, 1 per cent solution, or peroxide of hydrogen or liquid petrolatum. Sulphate of copper is too poisonous in itself, 460

Physostigma.

Atropine as a physiological antidote, external heat, and cardiac and respiratory stimulant, 461

POISON IVY. (See Rhus Poisoning.)

Procaine, 478

Sodium barbital, gr. 15 (1.0), 478

Scammony.

Treatment same as for gastro-enteritis, 496

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POLIOMYELITIS.

Antipoliomyelitis serum, 580
Methenamine as a prophylactic, 403

POSTPARTUM HEMORRHAGE, 876

Adrenalin chloride, 876
Autotransfusion, or actual transfusion of blood, necessary in some cases, 970

Morphine, gr. $\frac{1}{8}$ (0.008), hypodermically, after reaction is established, 969
Caffeine, strychnine, digitalis, pituitrin, adrenalin, or atropine, hypodermically as stimulants, 969
Drugs have been recommended as local applications, but are dangerous, 969
Enteroclysis, 969
Ergot, as a cure and prophylactic, 282, 876, 969
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Horse serum or human serum hypodermically or applied locally, 876
Hypodermoclysis, 969
Manipulations of the uterus, 969
Murphy drip, normal saline, to maintain temperature and relieve shock, 969
Pitocin hypodermically, 969
Pituitrin, 15 minims, hypodermically, 876, 969
Sodium bicarbonate, 2 per cent, or glucose, 3 per cent, injections if acidosis complicates, 969
Suture, if due to laceration, 969
Transfusion, 969, 970

PROLAPSUS RECTI.

Quercus, infusion, 482

PROSTATITIS, 851

Local treatment to prostatic urethra, and use of cold steel sounds in chronic types, 851
Perineal incision, to evacuate pus, if abscess forms, 851
Rest in bed, regulation of bowels, leeches to perineum, medication to render urine alkaline and morphine hypodermically or in suppository, 851
Soft catheter, allowed to remain in bladder, if retention of urine is persistent, 851

PRURITUS, 955

Alum solution in pruritus vulvæ, 94
Anesthone cream useful, 956
Arsenic, quinine, bitter tonics, cod-liver oil, alkaline diuretics or mineral waters, in debility, and avoidance of condiments if vulva or urethra is affected, 120, 955
Boric acid, 158
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